APPENDICES for

WELL 12-A

OPERABLE UNIT

A. Reference List
B. Detailed Geology, Response Actions, and Remedy Implementation
C. Data Review Figures
D. Site Inspection Trip Report, Photos, and Checklist
E. Public Notice
F. Interviews

APPENDIX A – REFERENCE LIST

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APPENDIX B – DETAILED GEOLOGY, RESPONSE ACTIONS, and REMEDY IMPLEMENTATION

B.1 Site Geology

The Well 12A project area is located in the Puget Sound Lowlands within the Commencement Bay drainage area. It is underlain by a sequence of glacial and interglacial deposits from the most recent glaciation. Several distinct channels were cut into these deposits by high velocity glacial meltwater, one of which is the South Tacoma Channel over which the site is situated. Where saturated, the coarse sands and gravels associated with these deposits make them conducive for high aquifer yields. Stratigraphy in the vicinity of the site is complex and characterized by discontinuous lenses of high and low permeability sediments. The primary units of interest at the site are described below (presented from shallowest to deepest). A three dimensional (3D) representation of the units is shown on Figure B-1. Hydraulic conductivity values are included, where appropriate, to show the relative permeability of each unit.

- Filter Cake and Artificial Fill. Fill material consists of material of variable grain size. Filtering of the tar-like sludge on the bottom of the waste oil tanks resulted in a filter cake material which was used as fill at various locations throughout the site.
- Steilacoom Gravels (Qvs). Generally characterized as gravelly sand and sandy gravel with varying silt content.
- Vashon Till (Qvt). Generally characterized as a diamict with a silty sand matrix supporting gravel and lesser amounts of cobbles and boulders.
- Vashon Advance Outwash Deposits (Qva). Generally characterized as poorly graded medium sand with varying amounts of gravel and silt. The water table is typically encountered in the Qva unit. Hydraulic conductivity in this unit has been calculated at 6-56 feet per day (ft/day).
- Sedimentary Deposits of pre-Fraser Glaciation Age, Undifferentiated (Qpf). Mixed fine and coarse grained deposits. Two non-contiguous fine-grained silt or clayey silt layers have been identified at the site; one generally above 200 feet (ft) mean sea level (msl) and one below 200 ft msl. Hydraulic conductivity within the fine-grained layer has been calculated at 0.12 ft/day.
- Coarse-Grained Deposits of pre-Fraser Glaciation Age (Qpfc). Generally characterized as coarse grained sand and gravel with varying amounts of silt and intermittent layers of saturated silty gravel. Hydraulic conductivity is highly variable: in gravel and sand layers it ranges from 58-3,555 ft/day and in silty sand or silty gravel layers it ranges from 0.9 to 10 ft/day.
- Coarse Grained Glacial Deposits of pre-Olympia Age (Qpogc). Similar in character to the overlying Qpfc. A color change and increase in fines were observed at the transition between the Qpfc and Qpogc. Measured hydraulic conductivities measured in the transition zone ranged from 0.6-1.5 ft/day. Well 12A is believed to be screened in the coarse sand and gravels layers within this unit. Hydraulic conductivities calculated from the Well12A aquifer test ranged from 874-5,921 ft/day.
- Till of pre-Olympia Age (Qpogt). Generally characterized as a very dense and dry sand and silt with fine gravel and a diamicitic texture characteristic of glacial till. This unit marks the upper portion of the primary aquitard at the site.
- Pre-Olympia deposits, undifferentiated (Qpon). Generally characterized as very dense or hard gravel, sand, silt and clay.

B.2 Hydrogeology

Groundwater in the upper aquifer is typically first encountered in the Qva unit at 30 to 35 feet below ground surface (bgs). The upper aquifer extends to approximately 100 feet bgs. Where present, the fine-grained Qpf unit may provide localized confining conditions. The principal aquitard (Qpogt), is a semi-confining unit approximately 30-40 feet thick that separates the upper from the lower aquifer. The lower aquifer is estimated at approximately 40 feet thick and is underlain by the Kitsap Formation, a regional confining unit. Groundwater flow at the site is complex due to multiple influences. The regional groundwater flow direction, without any impacts from pumping, is generally toward the east to northeast. When Well 12A is operational, the gradient shifts to the southwest.

The Well 12A project area is located within the South Tacoma Groundwater Protection District, which is a special zoning overlay district used to prevent the degradation of groundwater in the South Tacoma aquifer (Tacoma Municipal Code 13.09). It is managed by the Tacoma Pierce County Health Department (TPCHD). Certain facilities within this district are regulated based on their use or handling of hazardous substances. Regulated facilities are issued permits and are inspected biennially.

B.3 Initial Response

Discovery and NPL Listing. In 1981, chlorinated organic solvents were detected in groundwater at Well 12A that were above drinking water criteria at that time. As a result, the City of Tacoma Water Department voluntarily removed Well 12A from production during September of that year. EPA completed a site investigation between July and September 1981 and proposed the Commencement Bay/South Tacoma Channel site for listing on the National Priority List (NPL) on September 1, 1981. The site was added to the NPL on September 8, 1983.

Phase I Remedial Investigation. EPA authorized a Remedial Investigation (RI) to determine the source, type, and extent of contamination in April 1982. Eleven groundwater wells were installed and the results of subsequent groundwater sampling and analysis revealed the following concentrations of contaminants of concern (COCs) on site:

- trans-1,2-dichloroethylene (DCE) — 30 to 100 µg/L;
- PCA —17 to 300 µg/L;
- PCE — 1.6 to 5.4 µg/L; and
- TCE — 54 to 130 µg/L.

The RI study also determined that the major source of contamination was generally located northeast of Well 12A and that the natural, undisturbed groundwater flow direction was east and away from Well 12A. However, with the well field in production, the groundwater flow direction reversed, and the contaminant plume traveled toward the production wells.

The RI concluded that continued pumping of Well 12A could capture the contaminant plume even if other production wells were pumping. That is, pumping Well 12A could provide a hydraulic barrier to the spread of contamination and protect the rest of the well field. It was hypothesized that if Well 12A was not pumped to provide a hydraulic barrier, other operating wells could be impacted by the contaminant plume and could be lost for drinking water use.

Phase I Focused Feasibility Study/Initial Remedial Measures. In January 1983, EPA conducted a Focused Feasibility Study (FFS) to determine the most cost-effective treatment for Well 12A that would protect the drinking water supply for the City of Tacoma. The study included an Endangerment Assessment that evaluated risks to the general population if no action was taken. The FFS recommended

that an extraction and treatment (i.e., pump and treat) system with air stripping be implemented on an interim basis for treatment of Well 12A groundwater to control the spread of contamination and prevent the loss of the well field. Carbon adsorption was also considered for treatment of groundwater but was more expensive and was (initially) eliminated from further evaluation for use on site.
On March 16, 1983, EPA signed a Record of Decision (ROD) for a Remedial Action calling for the design and construction of five air stripping towers at Well 12A operating in parallel to treat up to 3,500 gallons per minute (gpm) of contaminated Well 12A groundwater. The ROD required treatment to be sufficiently protective of either human consumption or of aquatic life if discharged either to Commencement Bay or to the city's sanitary sewer system. The decision criterion used to determine discharge requirements was the concentration equivalent to a $1x10^{-6}$ excess cancer risk level as measured at the tap (after treatment and dilution in the system). Construction of the treatment system was authorized on March 24, 1983, and system startup occurred on July 17, 1983. The system was operated by the City of Tacoma until early November 1983 when production from the well field for that year's peak demand was no longer needed. Since that time, operation of the Well 12A treatment system of air stripping towers has continued on a seasonal basis (during peak demand) to reduce impact to the remaining well field and will continue until remediation is completed.

Phase II RI/FS. Because the Phase I RI identified only a general source location and not a specific site, EPA authorized a study of historical solvent use and disposal practices in the suspect area in December, 1982. Records of past investigations by TPCHD, Tacoma Water Division, and the Washington State Department of Ecology (Ecology) were reviewed and interviews were conducted with owners of numerous businesses in the area. A follow-up study focused on the historical uses and disposal of PCA in the vicinity of Well 12A. The focus on PCA was based on the fact that the RI determined this chemical to be the predominant contaminant and an uncommonly used solvent. Since few businesses nearby used PCA, these studies reduced both the number and location of potential sources of the contamination by process of elimination.

In May 1983, EPA authorized a supplemental Remedial Investigation and Feasibility Study (RI/FS) to further define the extent of groundwater contamination and to attempt to locate the source. Four monitoring wells were installed and sampled. Groundwater located near the Time Oil property contained concentrations of TCE, PCA, and *trans*-1,2-DCE in the low parts per million (ppm) range, which was substantially higher than detections in other wells, and orders of magnitude higher than at Well 12A. It was consequently determined that these monitoring wells were at or near the source of contamination.

With the apparent source area narrowed down substantially, EPA obtained air samples and near-surface soil samples along the Burlington Northern railroad spur north of the Time Oil property. Air sampling results showed very low contamination levels, but soil samples contained significant concentrations of TCE and PCA, confirming that this was the source of the contamination. The soil underlying the railroad track was composed of a fine-grained filter cake that had been generated during oil reprocessing operations at the site and disposed of on site. The filter cake consists of a tar-like sludge filtered from treated waste oil and is contaminated with high concentrations of lead (1 to 2%) as well as chlorinated organics.

Remedial alternatives were then developed to treat both the soil and the groundwater at the source and a proposed plan was issued for public comment.

B.4 Response Actions

The following section summarizes the remedial actions selected in the decision documents, describe the implemented remedial actions, and summarize the operation and maintenance (O&M) activities of the existing remedial systems.

The ROD, issued March 18, 1983, provided an Interim Remedial Measure (IRM) to address groundwater contamination at Well 12A. The 1983 remedy involved the installation and operation of an air-stripping system that would treat water pumped from Well 12A using five aeration towers operating in parallel. Treated water would be discharged to Commencement Bay or to the city's drinking water system depending on measured quality and the city's need. This remedy was meant as an interim measure until the source area could be identified and the contamination mitigated (USEPA, 1983).

Following the RI and FS (discussed in 1.3.4), the ROD was amended in May 1985 to require identification of source areas and treatment for soil and groundwater contamination within those source areas. The first ROD Amendment selected several major elements, including: continuation of the treatment at Well 12A using air stripping, excavation of contaminated soils, installation of a groundwater extraction and treatment system (GETS) using air stripping for treatment, and additional soil treatment by flushing using the extracted and treated groundwater, and capping of less-contaminated soils. The first ROD Amendment granted the EPA regional administrator authority to approve modifications to the choice and operation of certain aspects of the treatment system and soil remedy which are found to be "equivalent in effectiveness and cost or are necessary for the protection of health and the environment" (USEPA, 1985).

The IRM was amended in an April 28, 1987, memorandum to the Regional Administrator to include soil treatment by soil vapor extraction (SVE) instead of soil flushing and to include treatment of contaminated groundwater using carbon adsorption instead of air stripping in the Groundwater Extraction and Treatment System (GETS). These treatment systems were proposed to augment the air stripping system used for treatment of Well 12A groundwater that was used only during periods of peak demand. Selection of soil cleanup levels was postponed to a subsequent decision document.

In 2004-2005, EPA installed additional monitoring wells and collected soil samples and groundwater samples. Oily product was identified in some soil samples primarily collected from areas to the east of the Time Oil building. Groundwater contaminant concentrations and distribution had generally decreased compared to previous sampling events, although elevated concentrations of COCs were still found near the Time Oil property. In 2008, the third FYR concluded that the GETS was no longer effectively reducing contaminant concentrations and was not adequately controlling the migration of contamination (USEPA, 2008). Since the report concluded that the remedy was not protective, corrective actions were initiated.

In 2009, a Focused Feasibility Study (FFS) analyzing potential remedial alternatives to address ongoing contamination was completed (CDM, 2009). Shortly thereafter, a second amendment to the ROD was completed in October 2009 to address the COCs remaining in soil and groundwater. ROD Amendment #2 required continued operation of the GETS and treatment at Well 12A while adding the following remedy components:

- Excavation and off-site disposal of filter cake and contaminated soils;
- In-situ thermal remediation (ISTR) of soil and groundwater
- In-situ enhanced anaerobic bioremediation (EAB) of groundwater;
- Institutional controls (ICs) to avoid or limit exposure to site contamination and guide the use of the aquifer;

- Continued O&M of the GETS to prevent contaminant migration, with a contingency for monitored natural attenuation (MNA) to achieve further remediation once interim objectives have been achieved.
- Monitoring of the plume;
- Continued O&M of the air stripping units and groundwater monitoring for VOCs at Well 12A.

The remedy selected in Amendment #2 is considered a final remedy for soils and an interim remedy for groundwater that will be protective and assist in achieving the long-term objective of restoring the aquifer to its beneficial use as a drinking water source for the City of Tacoma.

During remedial design investigations, more residual source material was discovered beneath the Time Oil Building than was previously known. To address the additional source material, an Explanation of Significant Differences (ESD) was completed in June 2012 that modifies the remedy to include removal of the Time Oil Building to allow access to highly contaminated soils.

Table B-1 lists major activities and milestones for the Well 12A site/OU1.

Table B-1. Chronology of Site Events for Well 12A

Event	Date
Site Discovery	September 1981
Interim Priority NPL listing	November 1981
NPL listing	September 8, 1983
Phase I Remedial Investigation(RI)/Focused Feasibility Study (FFS) completed	January 1983
Record of Decision (ROD) Signature (Well 12A Stripping Towers Interim Remedial Measure (IRM))	March 18, 1983
Air Strippers begin operation at Well 12A	July 17, 1983
ROD Amendment (addressing source treatment)	May 3, 1985
Phase II Remedial Investigation/Feasibility Study completed	May 3, 1985
Unilateral Order (Potentially Responsible Party (PRP) 1)	June 3, 1985
Remedial Design Start – Groundwater	April 19, 1985
Remedial Design Complete – Groundwater	April 23, 1987
Remedial Design Modification (requiring soil vapor extraction system (VES)/carbon adsorption)	April 28, 1987
Remedial Design Start – Soil	March 19, 1985
Groundwater Extraction and Treatment System (GETS) begins operation	November 1988
Consent Decree for Settlement (PRP1)	November 4, 1988
Remedial Design Complete – Soil	June 5, 1991
Remedial Action Start –Soil Vapor Extraction (SVE)	July 19, 1990
SVE system begins operation	August 1993
Consent Decree for Settlement (PRP2)	January 31, 1995
Extraction Wells 2, 3, 4, and 5 added to GETS	1995

Remedial Action Complete – SVE shut down	November 1, 1997
First Five-Year Review	July 16, 1998
Light Non-aqueous Phase Liquid (LNAPL) and Soil Investigation Report	September 1999
CB/STC Construction Completion	September 29,
Remediation System Evaluation (RSE)	December 10,
Second Five-Year Review	July 2003
Capture Zone Analysis	September 2005
Third Five-Year Review	September 2008
Focused Feasibility Study (FFS) Completed	April 2009
ROD Amendment #2 (requiring additional source treatment)	October 2009
Remedial Design Investigation Conducted	October 2010
Shallow Excavation and Underground Storage Tank (UST) Removal Completed	May 2012
Explanation of Significant Differences (ESD) to the Amended ROD	June 2012
Remedial Design and In-Situ Thermal Remediation (ISTR) Pre-Design	July 2012
Mass Discharge Baseline Complete	January 2013
In Situ Thermal Remediation Implementation	November 2013 to November 2014
Enhanced Anaerobic Bioremediation Implementation	February 2014 to May 2014
ERH system operation to enhance EAB	August 2015 to February 2017
Final Post-Remedial Action Mass Discharge Evaluation Report	September 2017

B.5 Remedy Implementation

Collectively, the original ROD and ROD Amendments selected a multi-component remedy that was adapted as more information became available. Each component of the selected remedy is described below.

Well Head Treatment at Well 12A

The original 1983 ROD selected wellhead treatment at Well 12A using air strippers to treat pumped groundwater. This remedy was meant as an interim measure until the source area could be identified and the contamination mitigated. The air stripping system became operational in July 1983 and currently continues to operate when the well is pumped, which is typically during seasonal periods of peak demand. The system was constructed with five towers, each with its own blower and sized to treat up to 1000 µg/L of VOCs. Well 12A typically operates at about 3,500 gpm and the flow is split among the five towers. In 2012, electrical panels that support the blowers on the air stripping towers were upgraded; the communication system was simultaneously upgraded, which allows for remote operation by the City. Vapor from the stripping towers is not treated with vapor phase carbon and is discharged to the atmosphere. In 2009, the City of Tacoma switched to using only three towers during operation to save on costs.

All of Tacoma Water's wells are currently used on a seasonal basis rather than continuously. These groundwater sources typically supply approximately 5 percent of total annual water requirements, usually for summer peaking and to help maintain Green River minimum instream flows. The wells provide a critical supplement and backup water supply to meet demands that at times cannot be met from the Green River surface water supply system. It has been an established operating protocol for over 20 years that Well 12A must be run for sustained use of nearby wells, including 2B, 4A, 6B, 9A, and 11A. If 12A cannot be run, this would alone reduce total groundwater capacity by up to 25 MGD (million gallons per day). This would be a significant impact, as Tacoma Water's current goal is to maintain a short-term combined pumping capacity of approximately 55 MGD.

A list of approximate recent annual production from Well 12A was provided by the City of Tacoma (per the Log of Water Pumped maintained by Tacoma Water). For comparison, Well 12A has a nominal capacity of 5 MGD:

- 2018 – 0.3 MG (ran for sampling during part of a day in February)
- 2017 – 0 MG
- 2016 – 0.1 MG (ran for part of a day in April)
- 2015 – 681 MG (primarily ran in May-October due to drought)
- 2014 – 3 MG (ran for part of 3 days in February and March)
- 2013 – 10 MG (ran primarily in October)

Since October 2013, the only COCs detected in influent to the treatment system have been TCE, trans-1,2-DCE, and recently cis-1,2-DCE. Available influent (pretreatment) data is provided in Table B-2. Effluent data was not available.

Table B-2. Well 12A Pretreatment data

Date	Trichloroethylene (µg/L) MCL = 5.0	Trans-1,2-Dichloroethylene (µg/L) MCL = 100.0	Cis-1,2-Dichloroethylene (µg/L) MCL = 70.0
2/7/2018	1.3	<0.5	<0.5
4/6/2016	4.1	<0.5	<0.5
10/9/2015	5.6	0.96	1.3
9/24/2015	5.5	0.74	0.94
9/10/2015	5.8	0.72	0.87
8/27/2015	7.0	0.78	0.88
8/13/2015	7.1	0.68	<0.5
7/30/2015	6.2	0.6	<0.5
7/15/2015	5.0	0.56	<0.5
6/8/2015	3.3	0.5	<0.5
10/16/2013	1.5	<0.5	<0.5

Soil Excavation

Excavation and disposal of contaminated filter cake and shallow soils in and around the Time Oil Building was selected in the first ROD Amendment and again in Amendment #2. In 1986, Burlington Northern excavated approximately 1,200 cubic yards of contaminated soils along the rail spur. An

additional 5,000 cubic yards of waste sludge (filter cake) from the oil recycling operations were excavated as part of the SVE system construction in 1992.

During the remedial design investigation completed in 2010, a 14,280-gallon underground storage tank (UST) was encountered on the Time Oil property; the UST and adjacent soils (approximately 2,130 tons), including filter cake material, were subsequently removed and disposed at a permitted offsite disposal facility from December 2011 to March 2012. Due to differences in the type and concentrations of contaminants in soil, the excavation area was divided into a northern and a southern area. Soil in the southern area met RCRA Land Disposal Restrictions (LDRs). Soil in the northern area contained high levels of VOCs and required chemical treatment prior to disposal. Sodium persulfate and lime were used to reduce VOCs to levels that met RCRA LDRs. Final quantities removed included 6,775 gallons of UST liquids and 2,093 tons of contaminated soil. The final extents of the excavation are shown on Figure B-2.

Groundwater Extraction and Treatment System

The first ROD Amendment selected a GETS consisting of extraction well(s) at the source area, treatment of the extracted water by aeration, and discharge of the treated water to Commencement Bay. Treatment was later changed to carbon adsorption in the April 28, 1987 memorandum to the Regional Administrator, before the GETS system began operation in 1988. The overall objective of the GETS has been to limit migration of dissolved contaminants in groundwater.

The GETS system as originally installed in November 1988 consisted of one well (EW-1) designed to extract water at 500 gpm, although the maximum pumping rate recorded during initial operation was only 300 gpm. Sustained pumping rates at EW-1 significantly declined due to biofouling and in 1995, four additional extraction wells (EW-2 through EW-5) were added to the system to augment extraction. Wells EW-2 through EW-5 were designed to yield 50 gpm each, although maximum sustained rates during initial operation only ranged from 7.5-24 gpm. The treatment system consists of two bag filters arranged in parallel that precede two 20,000-pound granular activated carbon (GAC) units arranged in series. Effluent is discharged via storm drains to the Thea Foss Waterway which flows into Commencement Bay. The GETS extraction well locations are shown on Figure B-3.

Prior to system shut off during the implementation of ISTR and EAB, the GETS system was consistently operated, except for temporary shutdown periods for maintenance. Sustained pumping rates have declined since the system was installed. Prior to well rehabilitation in 2012, combined flows from the system were approximately 83 gpm. A GETS inspection and performance evaluation was completed in August 2011. The inspection identified several deficiencies that were later fixed, including replacement of pressure gauges, transducers, and the low-level switch at well EW-1. Rehabilitation was also recommended for wells EW-1 and EW-2 due to their significant decline in specific capacity. Rehabilitation was completed in 2012 using the Hydropuls© technology, which uses bursts of compressed nISTRogen along with extraction of groundwater to remove fines and biofouling accumulated on the well screen and filter pack. Rehabilitation resulted in a substantial improvement in extraction well yields and an increase in overall extraction rates by more than a factor of two.

Currently, only four extraction wells remain on site. Well EW-4 was located adjacent to the treatment area for ISTR and was decommissioned as part of the ISTR remedy. A GETS capture assessment was completed as part of the mass discharge evaluation and it was determined that well EW-3 was capable of maintaining full capture without EW-4 in operation. The GETS has been shut down since April 2013 during the EAB pilot test and remained off during the full-scale ISTR and EAB remedial activities. The treatment system is located south of the Time Oil property outside on a concrete pad surrounded by a chain-link fence. It consists of two bag filters arranged in parallel that precede two 20,000-pound GAC units arranged in series. Effluent from the second GAC unit was discharged to the City of Tacoma

stormwater system. Influent and effluent samples were collected bi-weekly by Tacoma Water personnel and sent to EPA's Manchester Laboratory for analysis.

Between 1988 and December 2012, the GETS treated over 860 million gallons of groundwater, removing approximately 18,625 pounds of VOCs. Influent concentrations of VOCs generally decreased from 2000 to 2009; however, contaminant concentrations observed in monitoring wells remain elevated. EPA contracted out the operation of the GETS from 1995 until operations were transferred to Ecology in Fall 2005.

During the period of December 27, 2012, through March 7, 2013, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride were the only chemicals that were detected in the discharge effluent from the GETS (Table B-3). Concentrations of cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride ranged from non-detect to 0.53 µg/L, non-detect to 0.26 µg/L and non-detect to 1.8 µg/L, respectively. All three detected chemicals in the effluent were present in concentrations below their respective MCLs of 70, 100, and 2 µg/L. State water quality standards for the protection of aquatic life are unavailable for the detected compounds although federal National Toxics Rule water quality standards include a vinyl chloride concentration of 2 µg/L for the protection of human health due to the consumption of water and organisms.

Table B-3. GETS effluent data during 2013 5YR period.

	12/27/2013	1/10/2013	1/24/2013	2/7/2013	2/21/2013	3/7/2013
cis-1,2-DCE	0.32	0.53	0.42 J	0.34 J	0.33 J	1.0 U
trans-1,2-DCE	1.0 U	0.26	1.0 U	1.0 U	1.0 U	1.0 U
PCA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
TCE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
VC	1.3	1.7	1.7	1.8	1.8	1.0 U

All units are µg/L.

Previously, Ecology changed out the carbon when values in the effluent (from both vessels) reached 10 µg/L for vinyl chloride (Chris Maurer interview, Appendix 1-D of 2013 FYR). This limit was based on empirical observations of the system and is considered more stringent than the former operating criteria of 10.7 µg/L for the sum of PCA and PCE; this limit is also well below the former discharge criteria proposed for vinyl chloride of 100 µg/L in the O&M manual (URS and CH2MHill, 2004). Using the 10 µg/L guideline value for vinyl chloride, Ecology determined that the typical carbon change-out frequency was twice per year, which has replaced the vinyl chloride limit requirement and is now the standard.

EPA resumed responsibility for operation of the GETS in July 2013 for implementation of the ISTR and EAB remedial activities. A baseline mass discharge measurement was completed in 2013 using a pumping test method conducted with the GETS. During remedial activities, the GETS remained offline. The GETS was restarted on November 14, 2016 for the post-RA pumping test to complete the Mass Discharge Evaluation. With the substantial reductions in source COC mass and reductions in mass discharge, there is little substantive benefit in continued GETS operations for containment and mass removal of the Time Oil source area. Therefore it was recommended that the GETS operations remain discontinued pending further evaluation of Tier 2 and 3 RAO compliance.

Prior to the recent remedial activities, when the GETS was operational, Ecology paid Tacoma Water to operate, maintain, and sample the five extraction wells. Ecology reported that the costs were about $100,000 per year, which includes two carbon change-outs ($40,000 per change out) and $20,000 for sampling performed by Tacoma Water personnel.

Soil Vapor Extraction

The SVE system was instituted after the first ROD Amendment under authority granted by the EPA Regional Administrator. In August 1993, an SVE system was installed and began operation. The system consisted of 22 vapor extraction wells in the area where drum storage and disposal operations had previously occurred west of the Time Oil building. Vapors were treated using carbon adsorption. Operation of the SVE system was discontinued in 1997 after soil contamination was reduced to concentrations that would not impact groundwater quality along the west side of the Time Oil building (USEPA, 2009). Between 1994 and May 1997, the SVE removed approximately 54,100 pounds of VOCs. Approximately 25 percent of the VOCs were chlorinated and the remainder consisted of light-end hydrocarbons.

In-Situ Thermal Remediation

ROD Amendment #2 selected ISTR to treat the highly impacted portions of the deep vadose zone and upper saturated zone near the former Time Oil building. Several phases of remedial design investigations in 2010 and 2011 have been completed and the results used to delineate the area for ISTR. Data collected during these and previous investigations were input into a 3D visualization model, Mining Visualization Software by CTech (MVS), to determine contaminant distribution in soil and groundwater.

During the Remedial Design investigation in 2010 and 2011, a total of 23 soil borings were advanced to determine the extent of contamination underneath and around the former Time Oil Building to be targeted by ISTR. This data served as the baseline for comparison to the ERH confirmatory sampling event. The highest concentrations of PCA, cis-1,2-DCE, TCE and PCE were observed in Boring B400 at 43 feet bgs at concentrations of 130,000 µg/kg, 48,000 µg/kg, 120,000 µg/kg, and 39,000µg/kg, respectively. Three of the borings that were used to bound the thermal treatment zone (TTZ), B428, B429, and B432, had concentrations of COCs in soil samples greater 5,000 µg/kg.

The proposed treatment area for ISTR was based on the modeled area containing COC soil concentrations greater than 5,000 µg/kg. This area is approximately 13,150 square feet in size and extends from the ground surface to a depth of 55 feet (see Figure B-4). The majority of the mass is contained in two zones, 0 to 10 feet bgs and 35 to 55 feet bgs.

The ISTR system was designed so that during ERH, electrical current would be passed through the soil and groundwater requiring VOC removal. A system of pressure vapor recovery wells, ERH condensers, and granular activated or oxidized KMn zeolite are utilized to collect, convey and treat the vapor and steam generated by the ERH remediation area. The treatment interval was 2 to 55 feet below ground surface. The total estimated mass of COCs in the ERH treatment volume was 186 kilograms. During design, it was estimated that 4,340,000 kilowatt-hours of energy would be required to achieve the soil cleanup goals and heating was estimated to last approximately 117 days.

Between November 2013 and November 2014, ISTR was successful in removing COCs and non-aqueous phase liquids (NAPLs) from the vadose zone and saturated zone within the treatment footprint, with a target treatment interval between 0 and 55 feet below ground surface (bgs). Samples from 40 feet bgs or deeper were considered to represent the saturated zone. From February 2014 and May 2014, EAB targeted areas where elevated COC concentrations were present above and within low-permeability silt

units, which are serving as both a boundary for dense non-aqueous phase liquid (DNAPL) vertical migration and as a continuing source of contamination through back diffusion.

ERH operations ceased on 28 July 2014 (Operations Day 117); vapor recovery continued through the confirmation sampling which ended 25 August 2014. Post-ERH confirmation sampling was performed by CDM-Smith in July 2014. Based on all data recorded during the baseline and confirmatory sampling events, ERH achieved an overall contaminant reduction across the site of 77.7%. Eliminating these data sets from the site-wide analysis indicates that the average reduction of contaminant concentrations of the six target COCs was 94.5%. Samples from 40 feet bgs or deeper were considered to represent the saturated zone.

Enhanced Anaerobic Biodegradation (EAB)

ROD Amendment #2 selected EAB to treat the high-concentration groundwater plume through injection of a carbon substrate to enhance reductive dechlorination under anaerobic conditions. Treatment was targeted along the interface of the Qpf silt unit, where high concentrations of residual contamination remained. A bench-scale study was completed in 2012 that recommended general biodiesel waste oil or Inland Empire crude vegetable oil with bioaugmentation (i.e., addition of cultured microorganisms). A pilot-scale EAB test began in April 2013 to evaluate the performance of the mixing and injection strategy. Full-scale EAB actions, including amendment injection, bioaugmentation, and buffering injections, were performed between February 2014 and June 2016.

Pilot Study

The pilot study evaluated injections of amendment consisting of xanthan gum and waste oil, with either sodium chloride or sodium bromide tracer, injections of buffering solution, and injections of bioaugmentation cultures. Three injection wells (INJ-1, INJ-2, and INJ-3) and five monitoring wells (EAB-1, EAB-2, EAB-3, EAB-4, and EAB-5) were installed for the EAB pilot study, and wells were screened either at shallow depths (approximately 45-65 feet bgs) or deep depths (approximately 80-90 feet bgs). The pilot study indicated that additional buffering injections were necessary to increase pH at some locations following amendment injection. The pilot study also indicate that bioaugmentation would be necessary to promote significant dechlorination of TCE in the shallow zone, but that bioaugmentation in the deep aquifer zone may not be necessary because VC, ethane, and ethylene were detected in the deep injection and monitoring wells during baseline sampling and following EAB amendment injections.

Injection Wells

Injection wells for EAB were installed from September 2013 to January 2014. A total of 44 injection wells (INJ-4 through INJ-47) and four monitoring wells (EAB-7, EAB-8, EAB-9, and EAB-10) were installed in order to complete full-scale EAB implementation. Screen intervals for injection wells installed in the middle zone of the Upper Aquifer were installed with screen intervals placed across the Qpf silt unit, with at least three feet of open screen interval present both above and below the Qpf silt to allow for amendment injections into the lithologic units surrounding the silt unit. The deep injection wells (INJ-6D through INJ-12D) were installed with screen interval between 80 and 90 feet bgs, in the lower portion of the Qpfc unit and above the Qpogc unit along South Tacoma Way. Monitoring wells EAB-7 and EAB-8 were installed in order to monitor the middle zone of the Upper Aquifer in the southern portion of the EAB treatment area, and were installed with screen intervals across the Qpf silt unit. Monitoring wells EAB-9 and EAB-10 were installed in order to monitor the deep interval injection near South Tacoma Way, with screen intervals between 80 and 90 feet bgs.

Injection Amendment Mixtures

The amendment mixture for each full-scale EAB injection well was composed of xanthan gum (shear thinning fluid), emulsified vegetable oil (either LactOil® or EOS 100®) (electron donor), and sodium bicarbonate (pH buffer). The composition of the mixture was adjusted for each injection well. Xanthan gum concentrations ranged from 0 to 0.125 percent (%) weight by weight (wt/wt), with higher concentrations (more viscous injection fluid) used at locations with higher observed specific capacities during injection well development.

LactOil® concentrations ranged from 3 to 5% (wt/wt) as carbon with higher concentrations used at locations with higher COC concentrations. Lactoil® at 5% as carbon was used at locations where total COC concentrations in groundwater were greater than 6,000 micrograms per liter (µg/L) during baseline sampling, or where total COC concentrations in soil were greater than 50,000 micrograms per kilogram (µg/kg). Lactoil® at 3% as carbon was used for all other injection wells.

Sodium bicarbonate was added as a buffer to prevent significant reduction in pH due to VFA formation following amendment injection. Approximately 0.08 grams (g) of sodium bicarbonate per g of carbon (i.e., between 1,200 to 2,000 milligrams per liter [mg/L]) was used. The final amendment injections completed in May 2014 had an increased sodium bicarbonate concentration ranging from approximately 3,600 mg/L to 6,800 mg/L
EOS 100® (5% as carbon) was used instead of LactOil® for areas in close proximity to the in situ thermal remediation (ISTR) treatment zone. LactOil® consists of approximately 45% vegetable oil and 35% ethyl lactate, and ethyl lactate dissolves in groundwater; therefore, LactOil® will likely be transported in groundwater away from the injection location. EOS 100®, on the other hand, consists of 100% vegetable oil and emulsifiers (i.e., no ethyl lactate). Based on conversations with EOS Remediation, LLC, EOS 100® can be advectively transported for up to 2 days, but then the oil emulsion breaks, and the oil adheres onto the soil matrix making it no longer mobile in the subsurface. Therefore, the EOS 100® is not expected to be transported as far away from the injection wells when compared to LactOil®. This was preferred for areas in close proximity to the ISTR treatment zone since the multiphase extraction causes a hydraulic gradient that draws groundwater toward the ISTR treatment zone. The intent of using EOS 100® in this area was to ensure that significant carbon was not drawn into the ISTR treatment zone during ISTR operations, which may cause significant fouling of the multi-phase extraction wells.

Full-Scale EAB Activities (February 2014 to May 2014 and November 2014)

Full-scale EAB injection started in February 2014 and completed in May 2014. Several wells did not achieve their target injection volumes due to extremely low injection rates including INJ-5, INJ-13, INJ-20, INJ-29, INJ-34, INJ-38, and INJ-42. To compensate, additional amendment was injected into wells in close proximity to aforementioned locations. A total of more than 850,000 gallons of amendment were injected from February 2014 through May 2014. Injection into INJ-37 was delayed until after completion of all ISTR activities, due to its close proximity to the ISTR system. From November 10 to 11, 2014, 17,840 gallons of amendment were injected at INJ-37.

Bioaugmentation Phase 1 (April 2014)

Phase 1 of bioaugmentation was completed in April 2014, and involved transferring approximately 100 gallons of groundwater extracted from MW-302 into select injection wells with sufficiently high pH value and low dissolved oxygen (DO) concentrations. Specifically, injection wells with pH values greater than 6.0 and DO values less than 1.0 mg/L, as indicated during low-purge, low-flow sampling, were considered suitable for bioaugmentation. MW-302 was chosen as the source of bioaugmentation as historical data collected at this location showed very high Dehalococcoides spp. (DHC) population combined with low VOC concentrations. Using these procedures, approximately 100 gallons of

groundwater extracted from MW-302 were injected into injection wells INJ-44, INJ-41, INJ-45, INJ-40, INJ-19, and INJ-15 on April 14, 2014, and INJ-30 on May 7, 2014.

Buffering Injection Summary (November to December 2014)

The supplemental amendment and buffer injection event began on November 10, 2014 and was completed on December 5, 2014. A few wells, INJ-16, INJ-27, did not achieve their target injection volumes due to low injection flow rates and the time allotted to complete the injection event. To compensate and complete the injection event on schedule and use all of the mixed buffering amendment, the additional buffer (4,346 gal) intended for INJ-16 and INJ-27 was injected into injection well INJ-3. INJ-3 was selected for the additional buffering amendment because it would readily accept the additional volume and because of its proximity to EAB-1 where 1,1,2,2-tetrachloroethane (PCA) dense non-aqueous phase liquid (DNAPL) has been observed. Additional buffer is beneficial in DNAPL areas to counteract the additional acid production from reductive dechlorination and hydrolysis of chlorinated ethylenes and ethanes. A total of 128,044 gal of buffer amendment was injected between November 10, 2014 and December 5, 2014.

Bioaugmentation Phase 2 and 3 (December 2014 and June 2016)

Additional bioaugmentation, Phase 2, was completed in December 2014 at two high concentration areas (i.e., containing DNAPL) of the Well 12A Site. High dissolved concentrations of PCA at INJ-30 (944,000 µg/L in August 2014) and EAB-1 (93,100 µg/L in August 2014) along with the presence of DNAPL had been consistently observed. Due to the presence of DNAPL, significant acid production resulted in lower aquifer pH, even with supplemental buffering, due to reductive dechlorination and hydrolysis of contaminants. Therefore, bioaugmentation was implemented at those locations with a culture (SiREM's KB-1® Plus culture) that was enriched specifically to degrade high concentrations of chlorinated ethanes (including PCA). In addition, this culture was selected due to its acclimated ability to dechlorinate in low pH groundwater as low as 5.8 (SiREM 2015). Tolerance for low pH was important for these locations because, prior to buffer injections performed in late 2014, groundwater pH at INJ-30 and EAB-1 was below the optimal range for reductive dechlorination. Furthermore, dechlorination generates hydrochloric acid, which can be significant in DNAPL areas. Although significant dechlorination was occurring at both of these locations, the goal was to improve dechlorination kinetics further to address the high concentrations of COCs dissolving from the DNAPL source.

In order to attempt to stimulate more robust reductive dechlorination at INJ-30 during thermally enhanced bioremediation, an additional bioaugmentation event, Phase 3, was completed in June 2016. This bioaugmentation event consisted of transferring approximately 720 gallons of groundwater from monitoring well WCC-1B, which contained elevated populations of dechlorinating bacteria, to injection well INJ-30.

Monitored Natural Attenuation

ROD Amendment #2 selected MNA as a contingency to implement once interim objectives have been achieved and Tier 1 objectives have been met (i.e. 90% mass discharge reduction). Groundwater monitoring will be used to determine if the GETS operation can be discontinued and MNA can be relied on to achieve the long-term groundwater monitoring objectives of meeting cleanup levels in a reasonable timeframe.

Groundwater Monitoring

ROD Amendment #2 selected groundwater monitoring as the means to determine if RAOs have been achieved. Remedial performance monitoring will be used to evaluate the progress of ISTR and EAB toward meeting Tier 1 objectives. Interim performance monitoring points will be used to determine when

Tier 2 objectives have been met (i.e. achieve cleanup levels at points of compliance). A 30-year monitoring and evaluation program will be implemented to monitor remedial performance and determine if Tier 3 objectives can be met in a reasonable timeframe (i.e. achieve cleanup levels throughout plume).

To date, twelve rounds of monitoring have been completed since ROD Amendment #2 was signed:

- Event 1, Fall 2011. The objective of this event was to fill data gaps in the CSM.
- Event 2, Summer 2012. The objective of this event was to fill data gaps in the CSM.
- Event 3, December 2012. The objectives of this event were to evaluate passive sampling devices and establish concentration trends in newly installed interim performance monitoring wells (IM series).
- Event 4, Summer 2013. The objective of this event was to supplement the EAB Pilot Study monitoring program (which monitored before injection, during injection, 1 month post injection, and 3 months post injection). The sampling of 3 wells (MW313, MW-314, and WCC-1B) during the 3 month post injection monitoring event constitutes Well12A Site Groundwater Performance Monitoring Event 4.
- Event 5, October 2013. The objectives of this event were to collect analytical data to evaluate EAB performance 6 months after the pilot study amendment injections
- Event 6, January 2014. The objectives of this event were to collect analytical data to evaluate EAB performance 9 months after the pilot study amendment injections
- Event 7, June 2014. The objective of this event was to collect analytical data to evaluate electron donor concentrations and pH after full-scale enhanced anaerobic bioremediation (EAB) injections were complete, evaluate EAB performance 14 months after the EAB pilot study amendment injections were completed, and monitor concentrations of VOCs in the vicinity of the in situ thermal remediation (ISTR) treatment area.
- Event 8, August 2014. The objective of this event was to collect analytical data to evaluate enhanced anaerobic bioremediation (EAB) performance 3 months after completion of the full-scale EAB amendment injections and to monitor concentrations of VOCs in the vicinity of the in situ thermal remediation (ISTR) treatment area.
- Event 9, January 2015. The objective of this event was to collect analytical data to evaluate EAB performance 7 months after completion of the full-scale EAB amendment injections, to evaluate additional buffer injections conducted in November 2014, bioaugmentation into INJ-30 and EAB-1 conducted in December 2014, and to monitor aquifer conditions of VOCs in the vicinity of the in situ thermal remediation (ISTR) treatment area.
- Event 10, June 2015. The objective of this event was to collect analytical data to provide a comprehensive data set to evaluate enhanced anaerobic bioremediation (EAB) performance one year after completion of the full-scale EAB amendment injections.
- Event 11, Fall 2015. The objective of this event was to evaluate performance of the overall EAB remedy approximately 20 months after completion of the full-scale EAB implementation, performance of the targeted low-temperature thermally-enhanced bioremediation, and evaluation of the effects of the City of Tacoma municipal well field operation on the EAB remedy and nature and extent of groundwater contamination.
- Event 12, August 2016. The objective of this event was to allow for evaluation of the performance of the overall site-wide remedy approximately 26 months after completion of the full-scale EAB implementation, 24 months after completion of the in situ thermal remediation (ISTR) remedy in the vicinity of the Time Oil building, and after 12 months of low-temperature ERH system operations.

Institutional Controls

ROD Amendment #2 selected ICs to protect human health by limiting access to and future development, improvement, and use of affected properties. An IC Plan was drafted in 2010 describing ICs for the site. The types of ICs selected include proprietary, such as restrictive covenants; governmental, such as zoning ordinances, well drilling regulations, or local building/development permits; and informational devices, such as EPA fact sheets. Following achievement of the Tier 1 objectives, soil and groundwater contamination may still be present at levels above those that would be protective of human health and ICs will be re-evaluated. A summary of the selected ICs and their current status is discussed in Section 2.5.

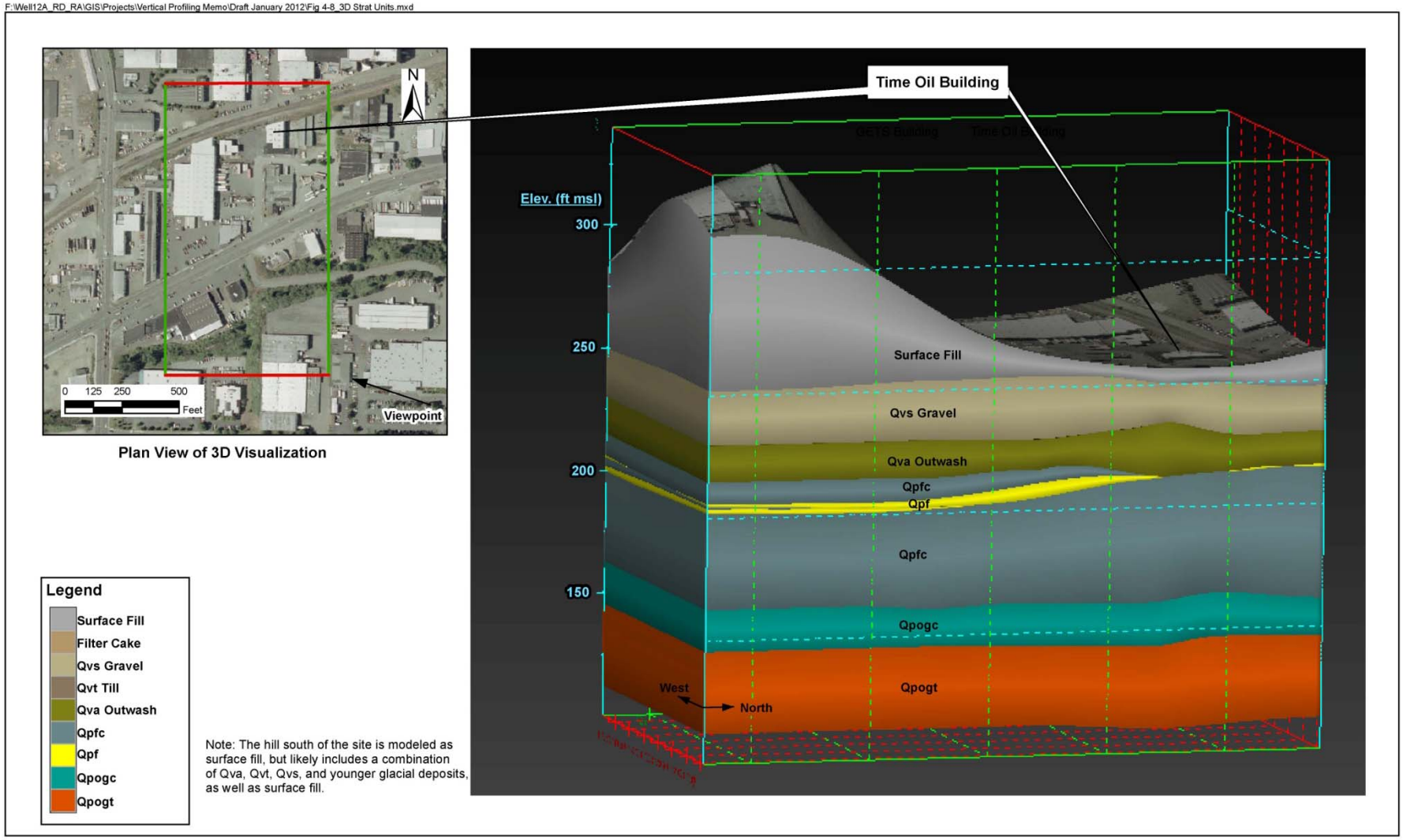


Figure B-1. Representation of stratigraphic units.

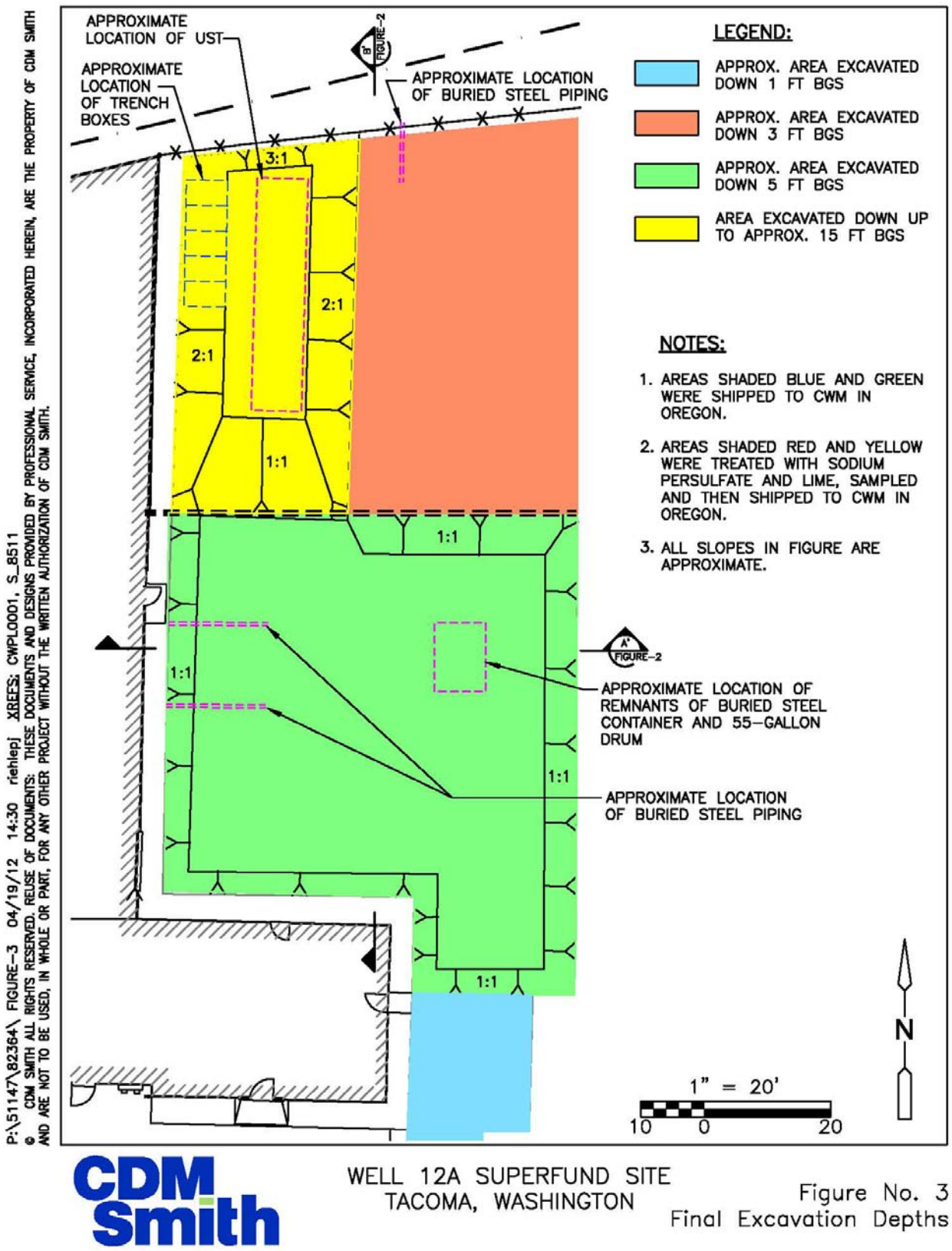


Figure B-2. 2011/2012 final extent of excavation.

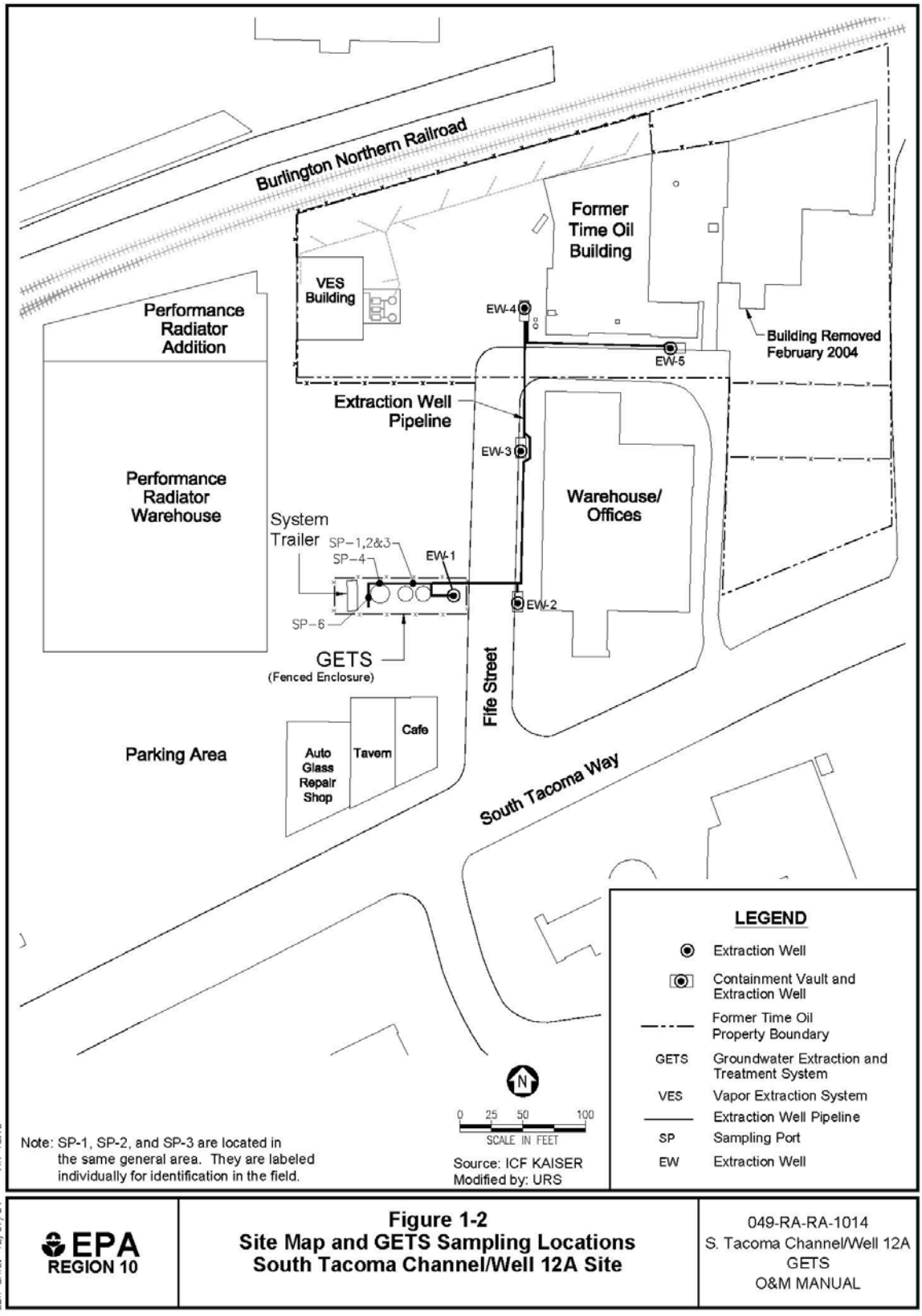


Figure B-3. Groundwater extraction and treatment system (GETS) location map.

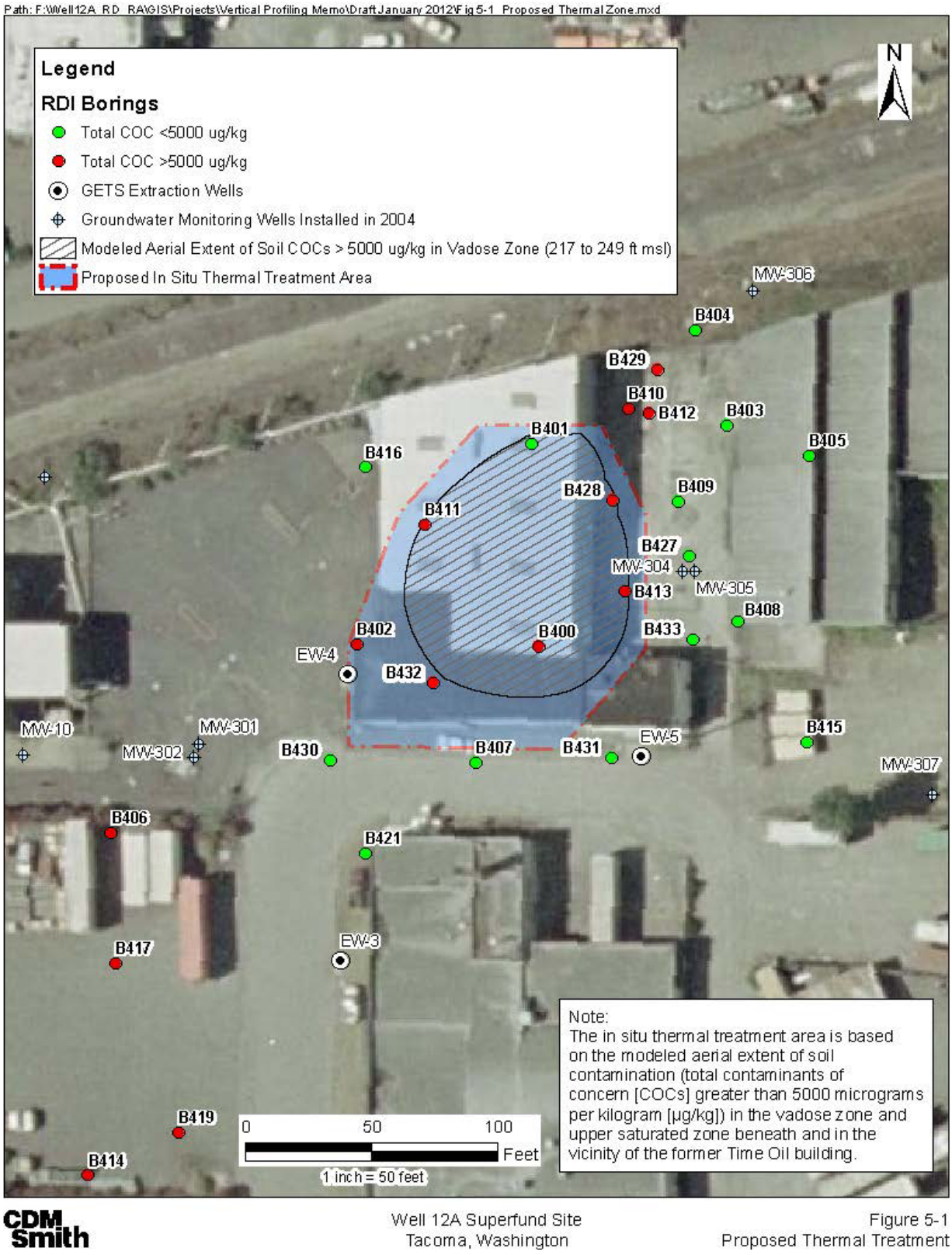
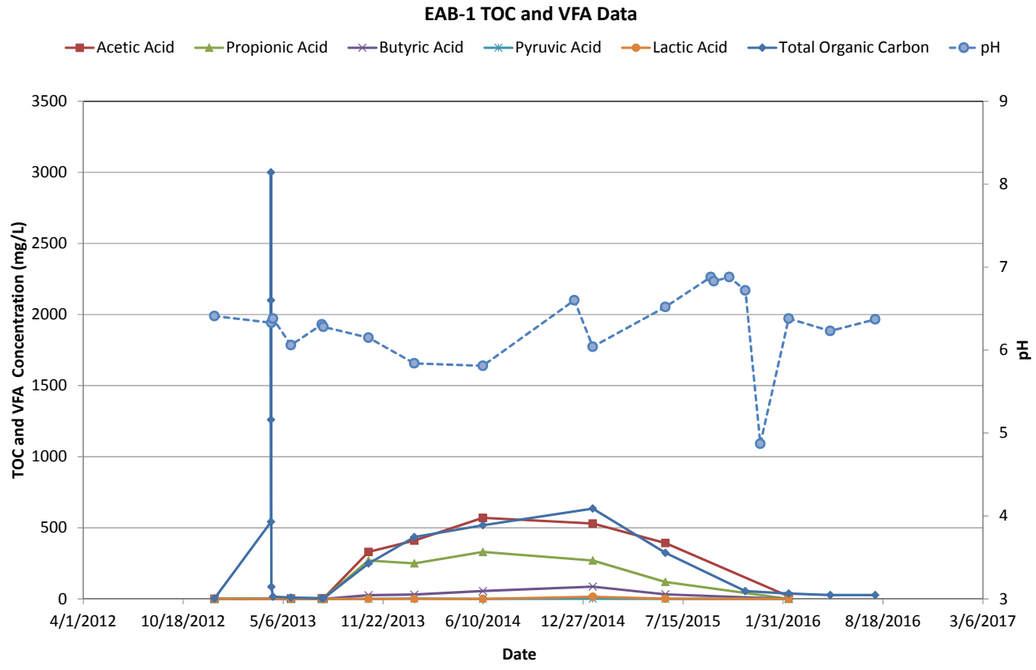
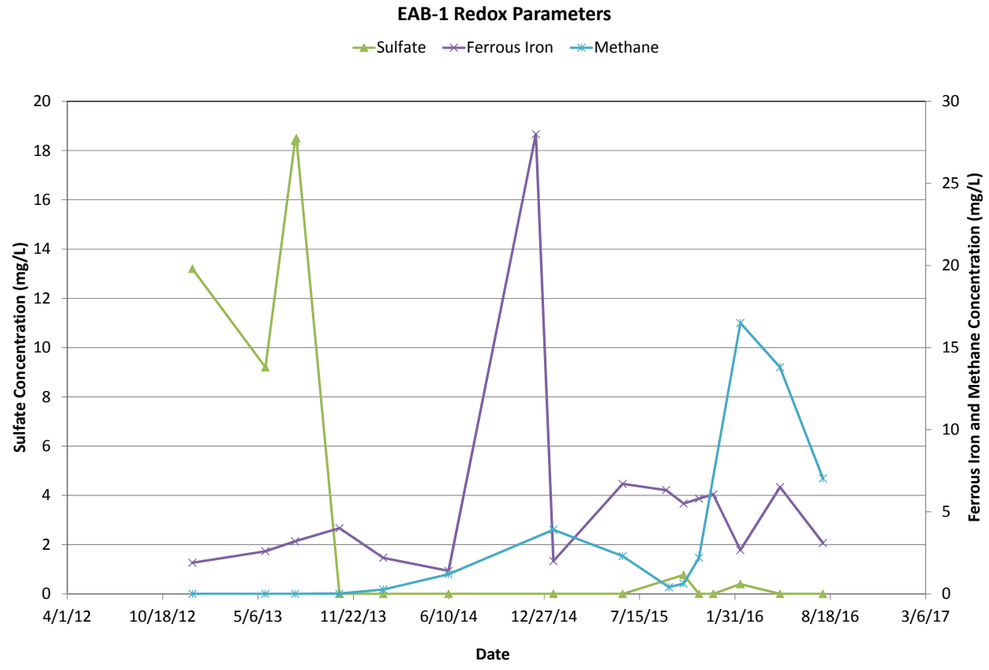
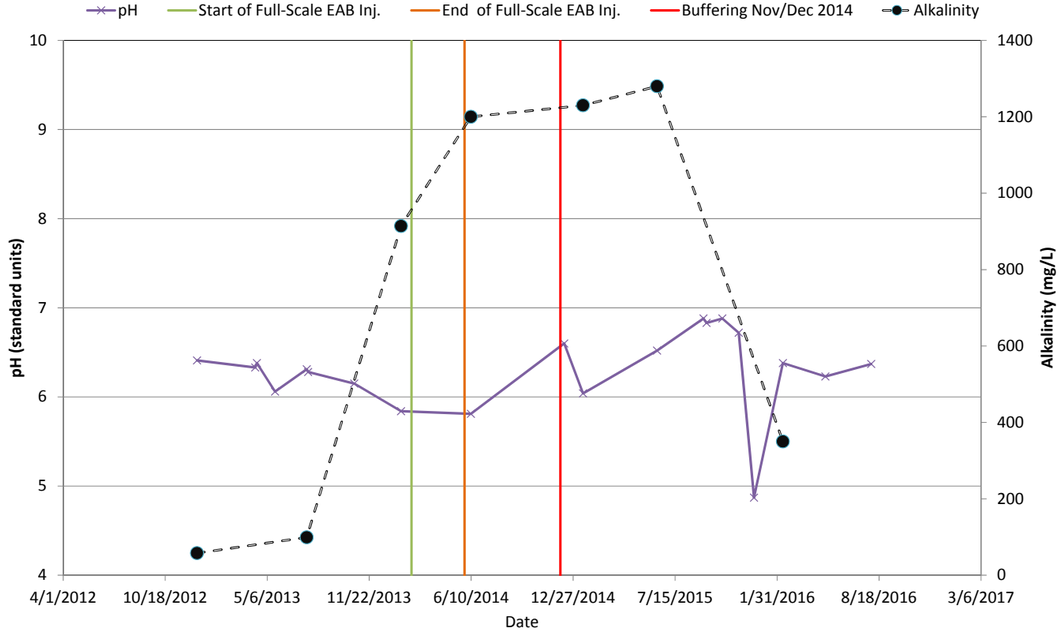


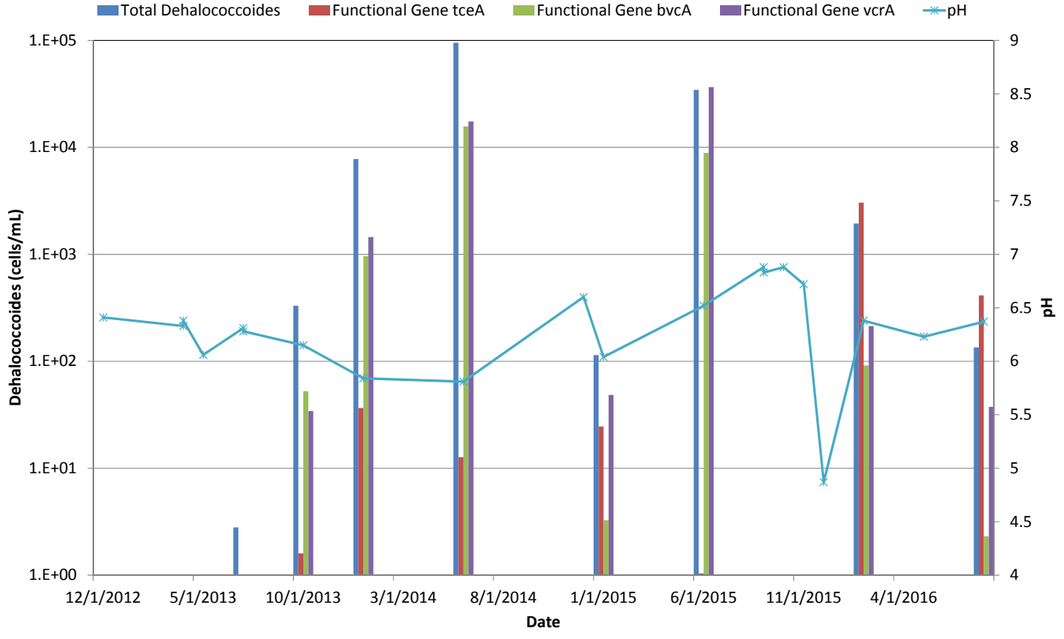
Figure B-4**. Proposed in-situ thermal remediation (ISTR) treatment area.**

APPENDIX C – DATA REVIEW FIGURES





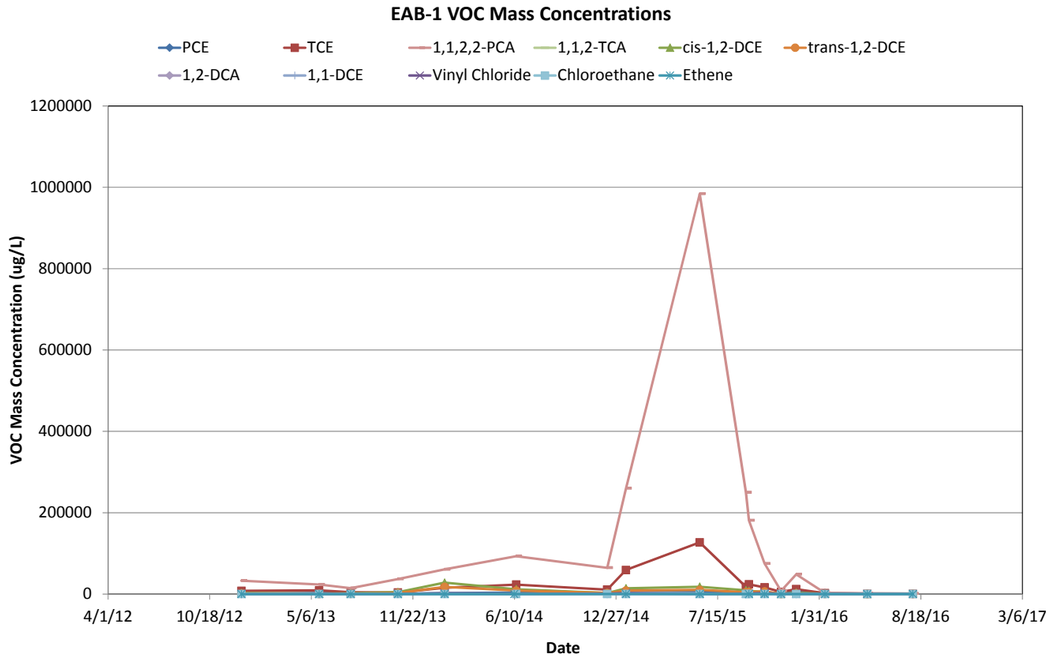




CDM Smith

Analytical Data Trends for Thermally Enhanced Bioremediation Wells

Groundwater Performance Monitoring
Well 12A Superfund Site, Tacoma, Washington


EAB-1 VOC Mass Concentrations
PCE
TCE
1,1,2,2-PCA
1,1,2-TCA
cis-1,2-DCE
trans-1,2-DCE
1,2-DCA
1,1-DCE
Vinyl Chloride
Chloroethane
Ethene
VOC Mass Concentration (ug/L)
1200000
1000000
800000
600000
400000
200000
0
4/1/12
10/18/12
5/6/13
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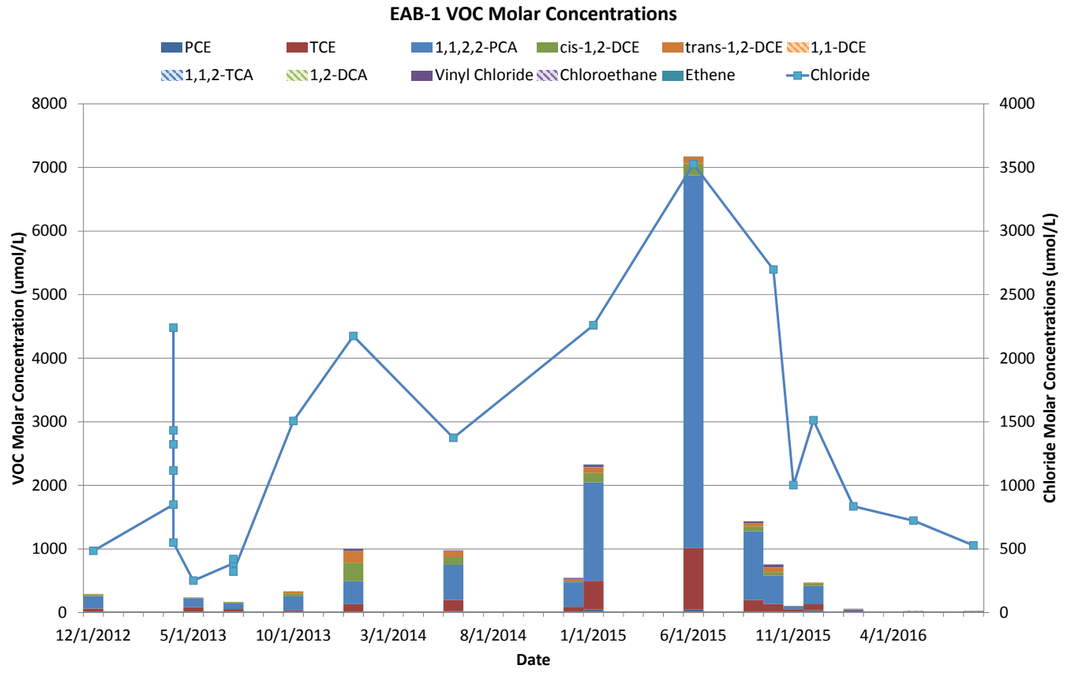
12/27/14
7/15/15
1/31/16
8/18/16
3/6/17
Date


EAB-1 VOC Molar Concentrations
PCE
TCE
1,1,2,2-PCA
cis-1,2-DCE
trans-1,2-DCE
1,1-DCE
1,1,2-TCA
1,2-DCA
Vinyl Chloride
Chloroethane
Ethene
Chloride
VOC Molar Concentration (umol/L)
8000
7000
6000
5000
4000
3000
2000
1000
0
Chloride Molar Concentrations (umol/L)
4000
3500
3000
2500
2000
1500
1000
500
0
12/1/2012
5/1/2013
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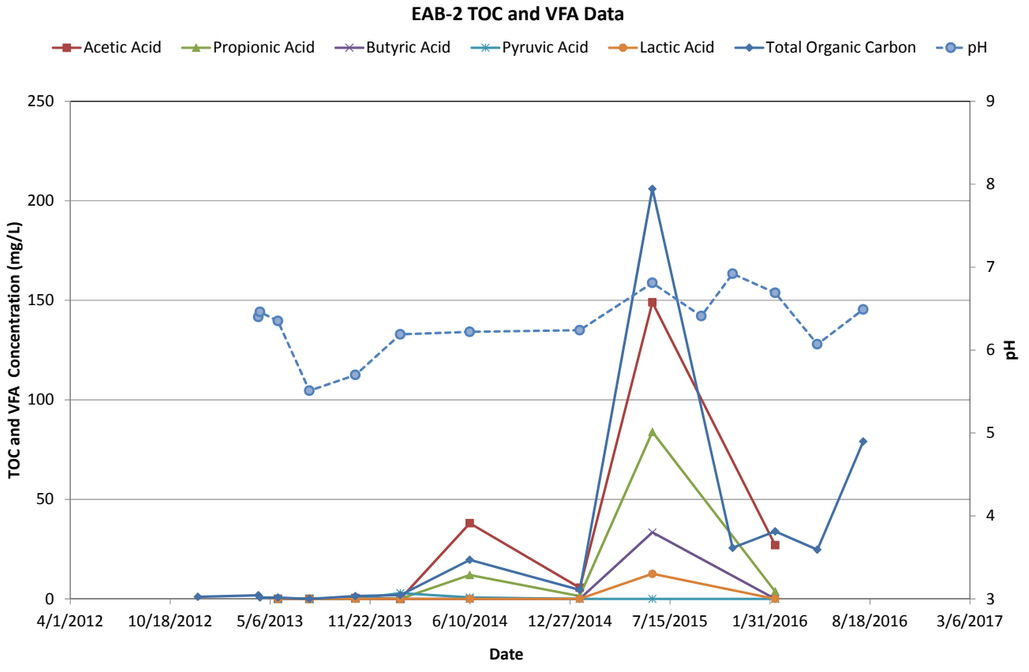
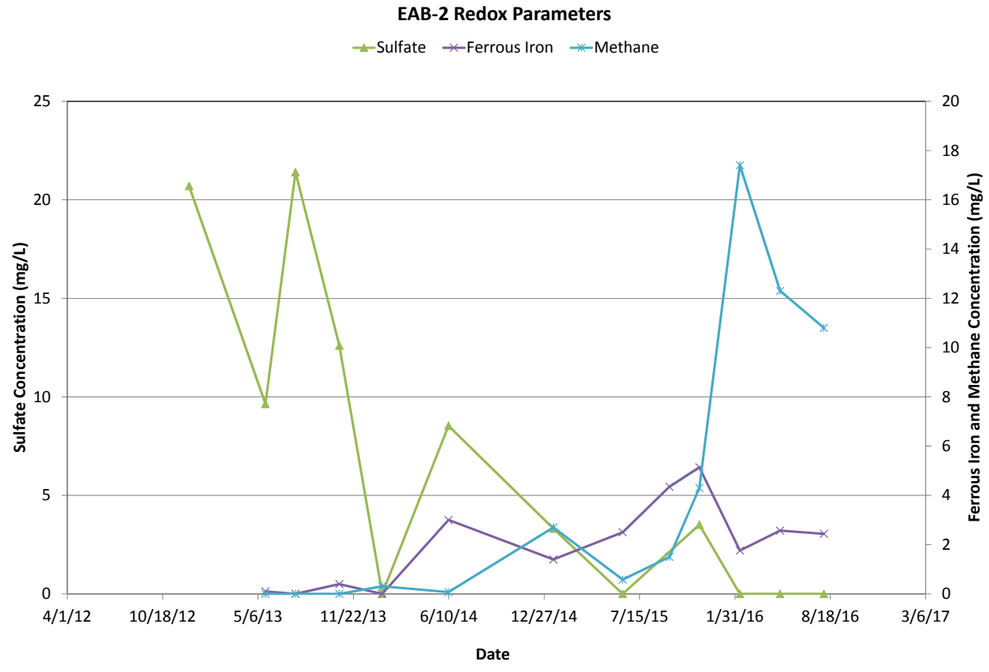
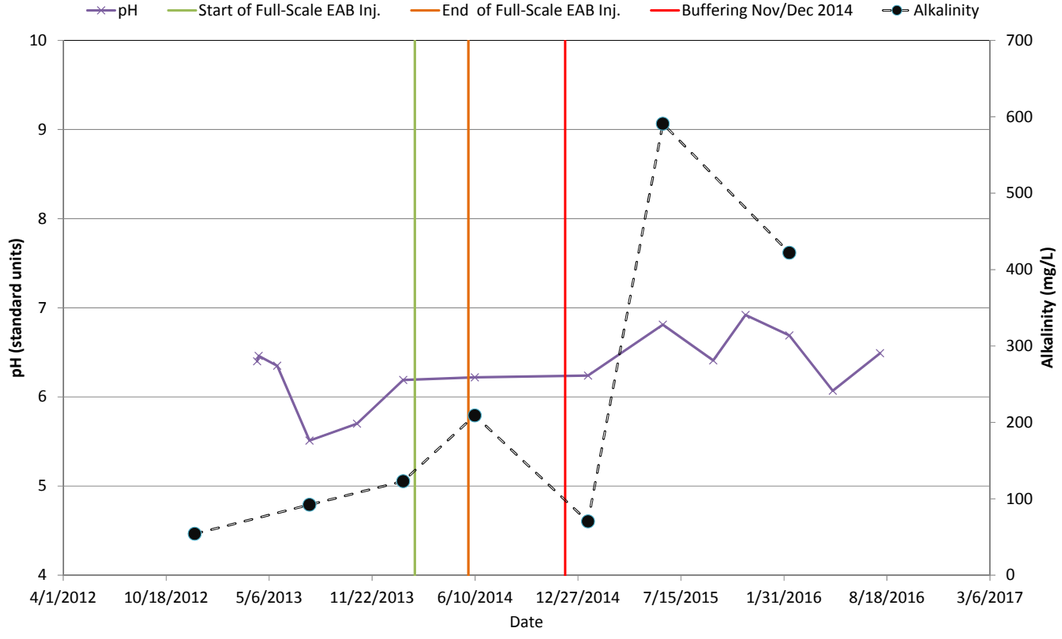
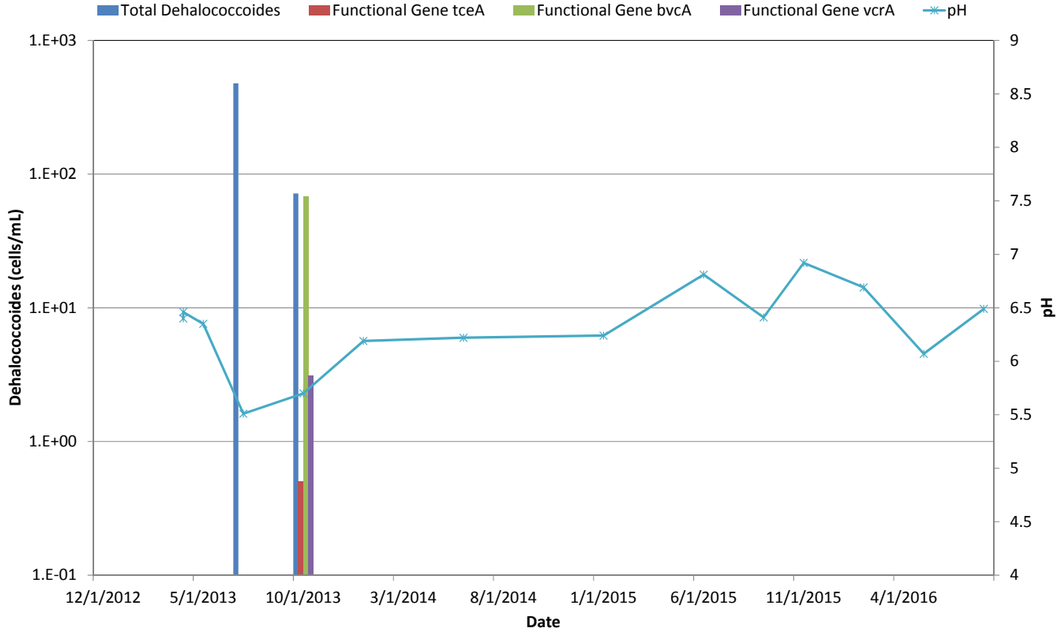
4/1/2016
Date





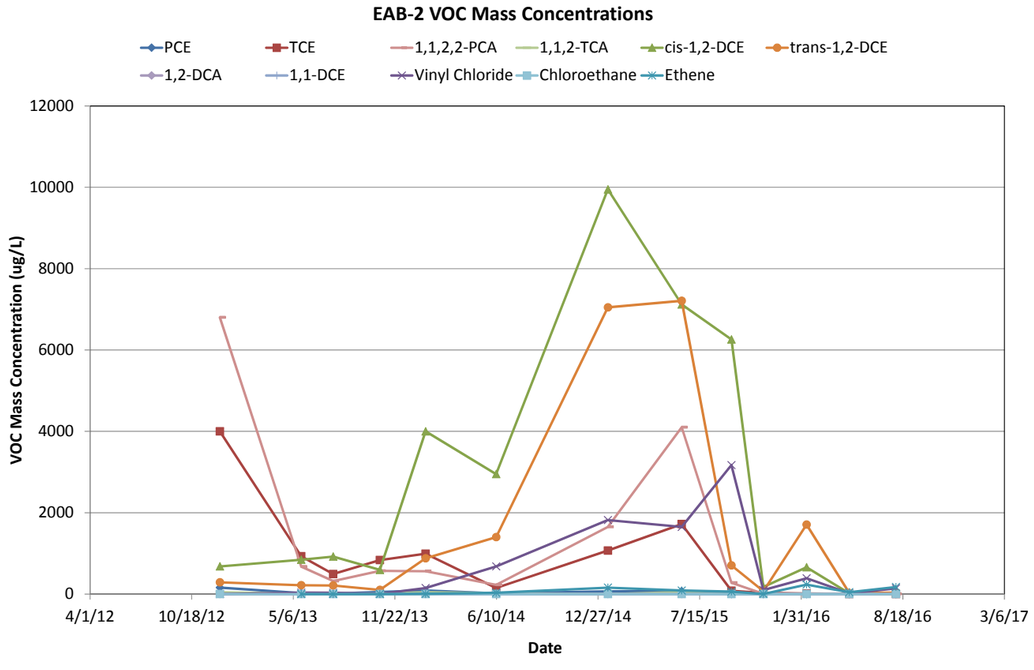




CDM Smith

Analytical Data Trends for Thermally Enhanced Bioremediation Wells

Groundwater Performance Monitoring
Well 12A Superfund Site, Tacoma, Washington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TCE
1,1,2,2-PCA
1,1,2-TCA
cis-1,2-DCE
trans-1,2-DCE
1,2-DCA
1,1-DCE
Vinyl Chloride
Chloroethane
Ethene
VOC Mass Concentration (ug/L)
12000
10000
8000
6000
4000
2000
0
4/1/12
10/18/12
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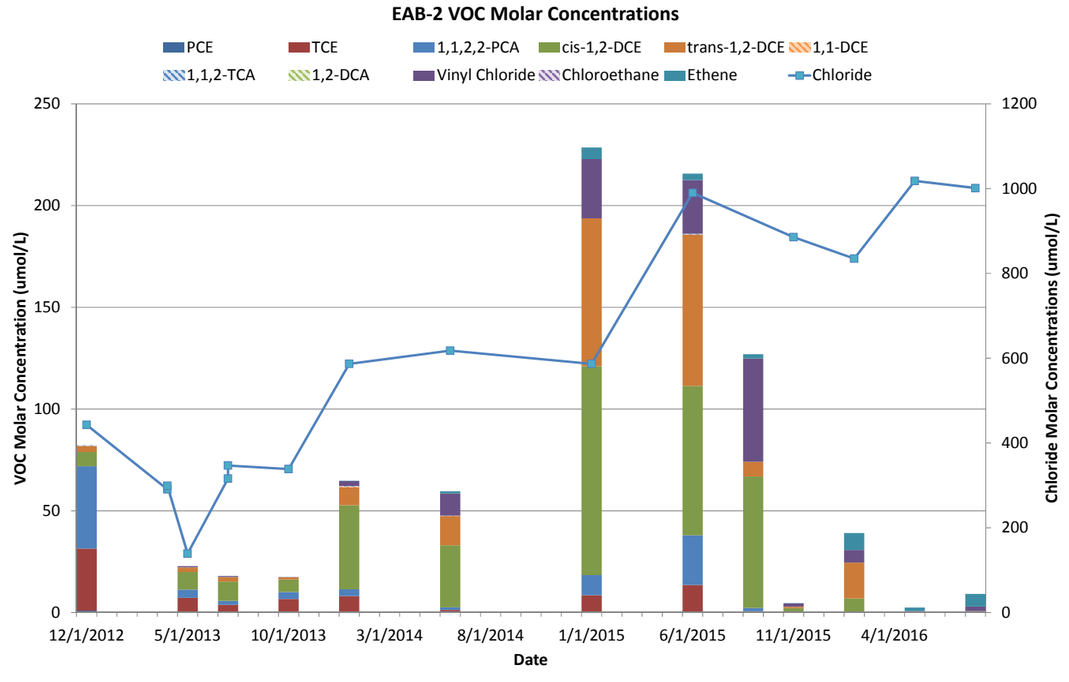
1/31/16
8/18/16
3/6/17
Date


EAB-2 VOC Molar Concentrations
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TCE
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cis-1,2-DCE
trans-1,2-DCE
1,1-DCE
1,1,2-TCA
1,2-DCA
Vinyl Chloride
Chloroethane
Ethene
Chloride
VOC Molar Concentration (umol/L)
250
200
150
100
50
0
Chloride Molar Concentrations (umol/L)
1200
1000
800
600
400
200
0
12/1/2012
5/1/2013
10/1/2013
3/1/2014
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6/1/2015
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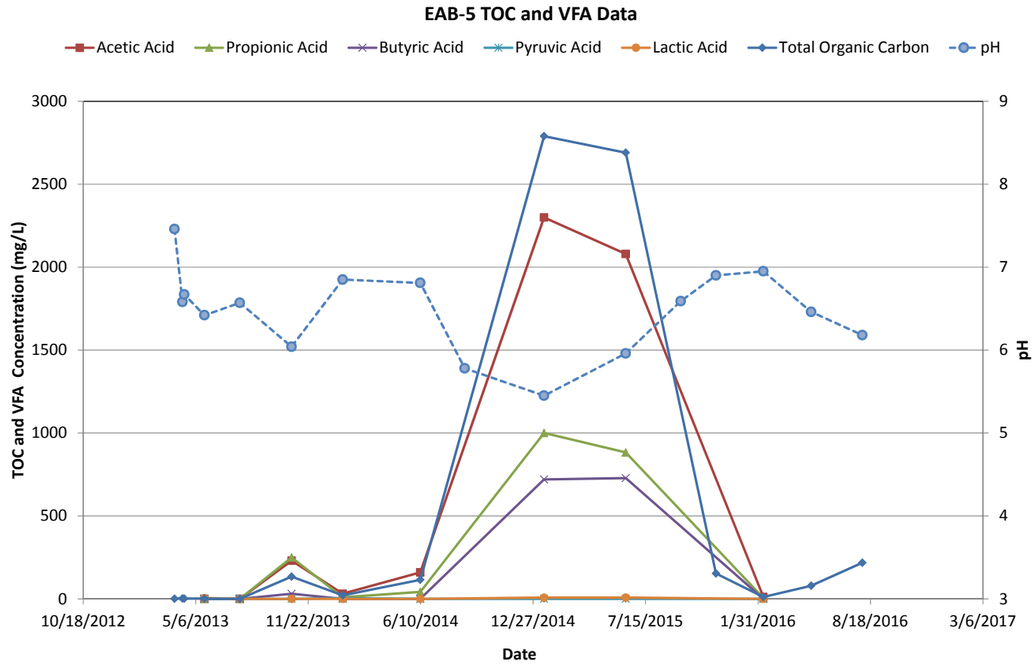
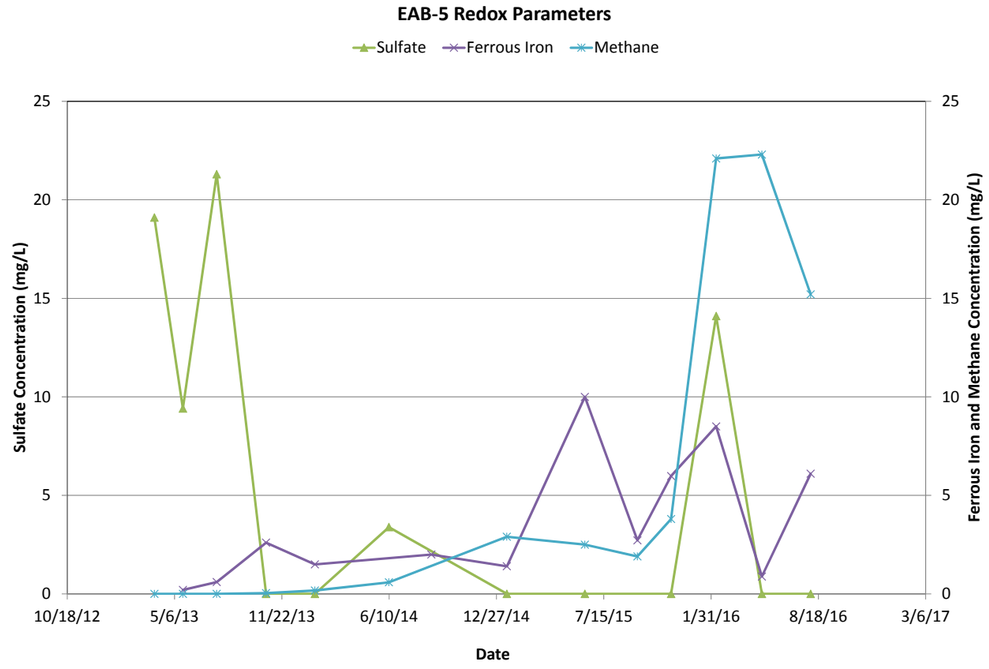
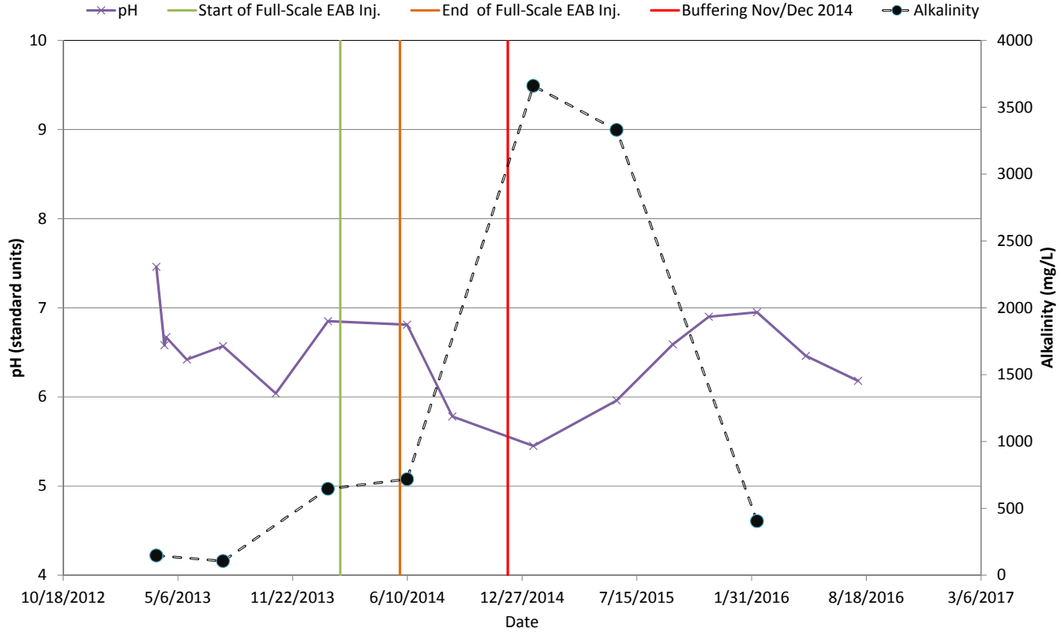
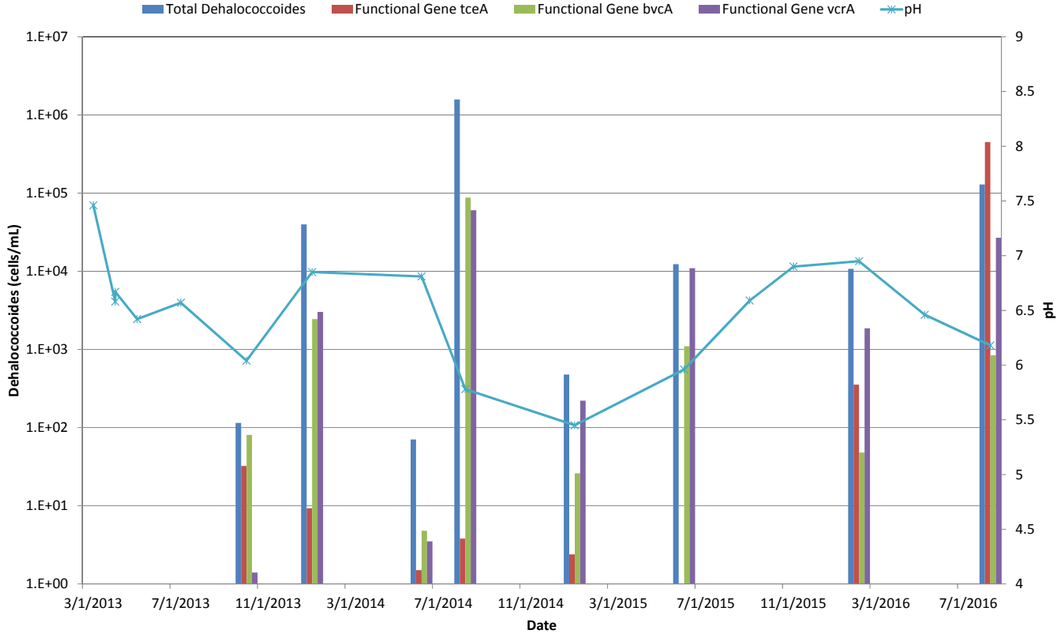




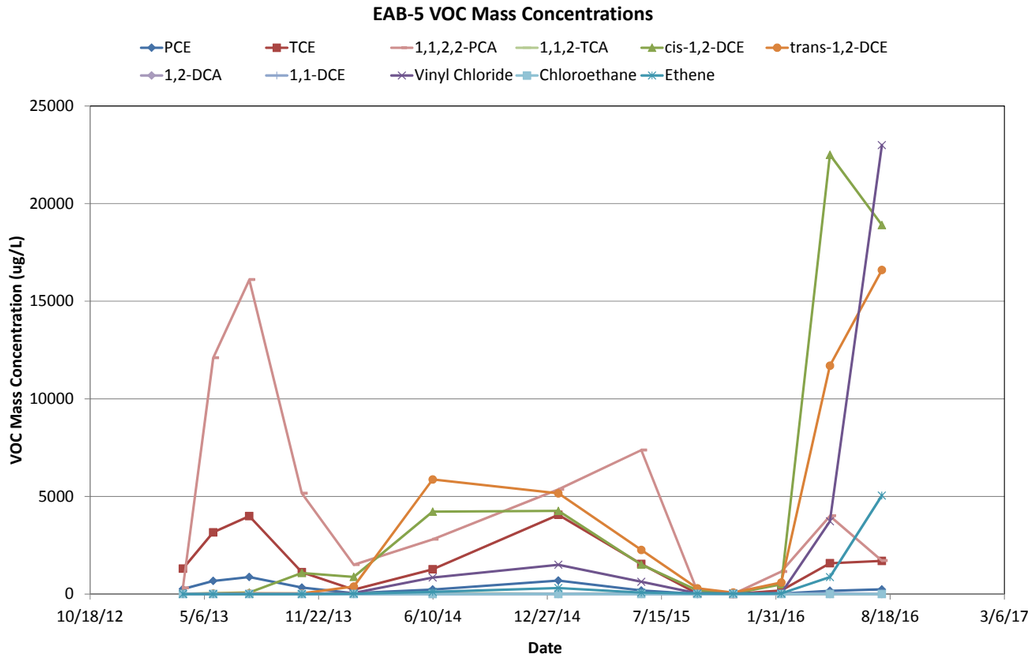




CDM Smith

Analytical Data Trends for Thermally Enhanced Bioremediation Wells

Groundwater Performance Monitoring
Well 12A Superfund Site, Tacoma, Washington


EAB-5 VOC Mass Concentrations
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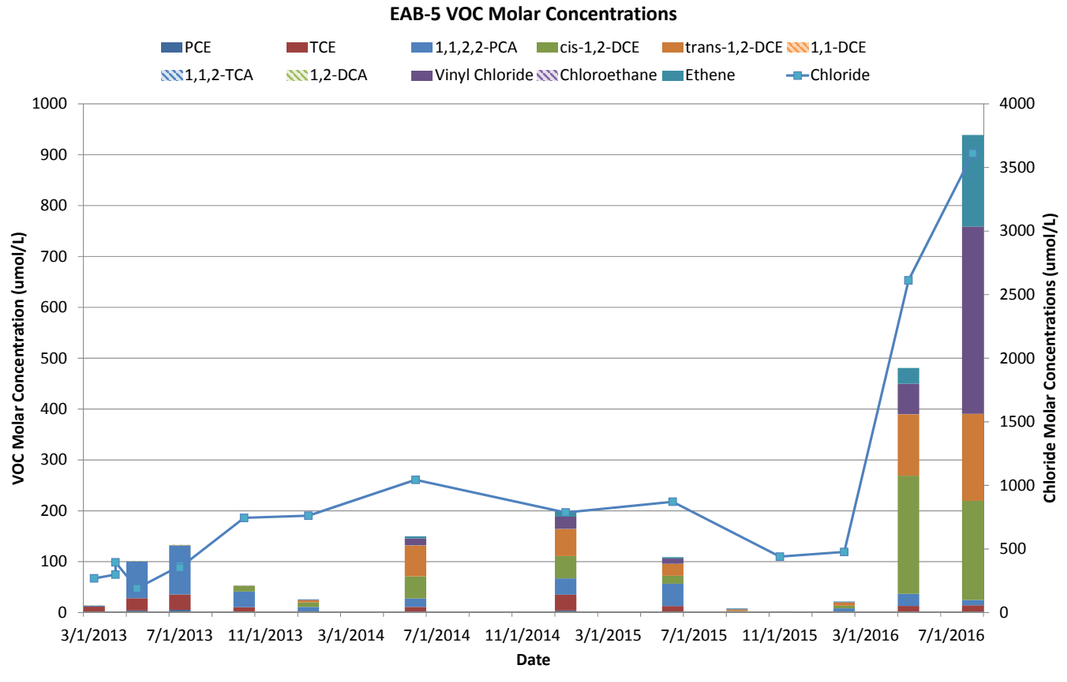
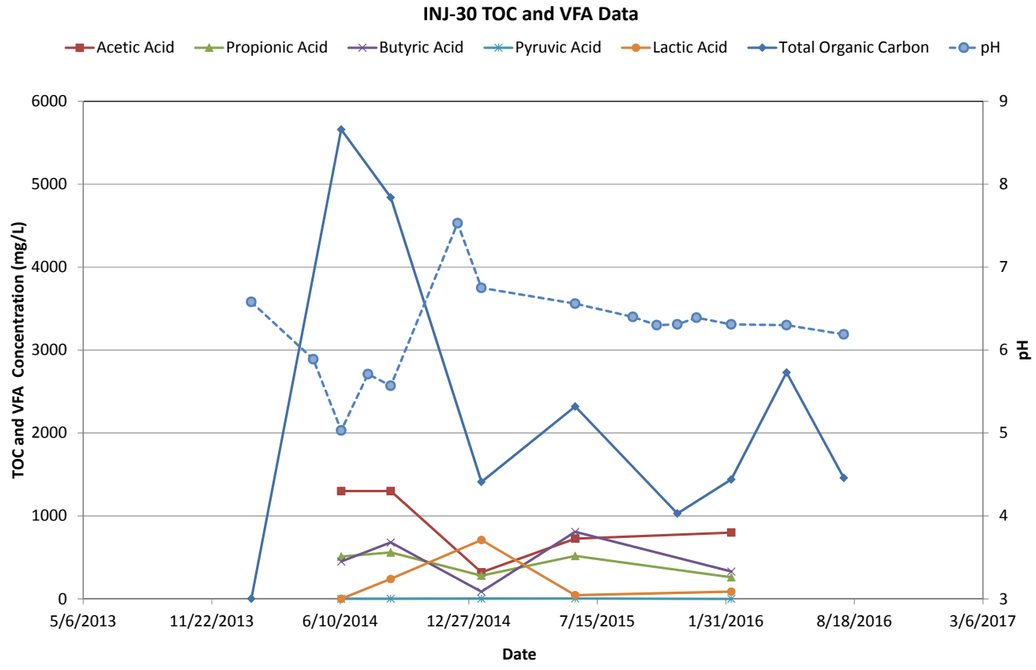
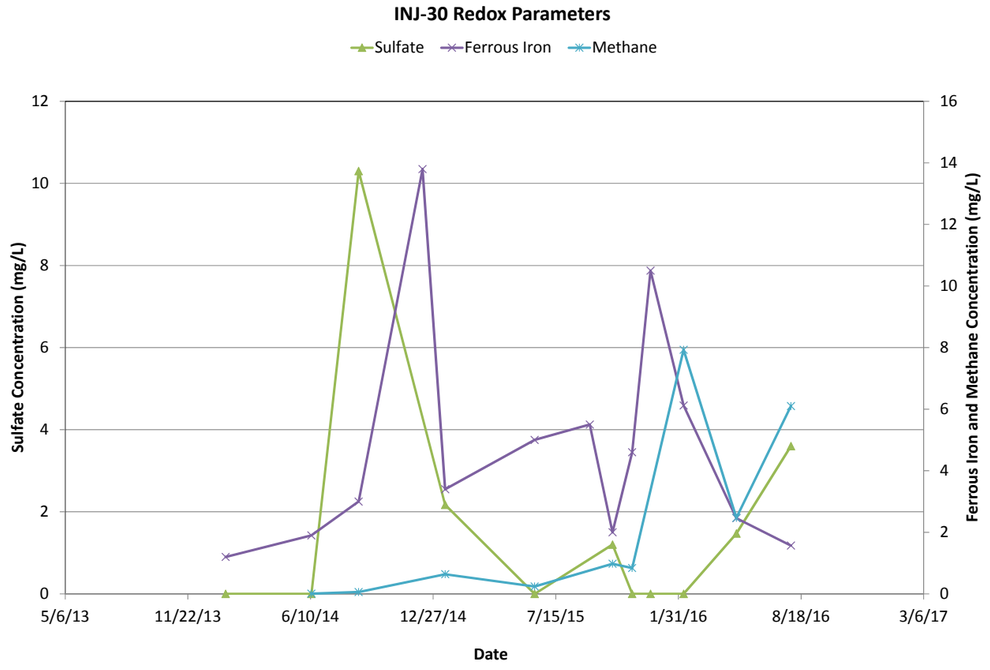
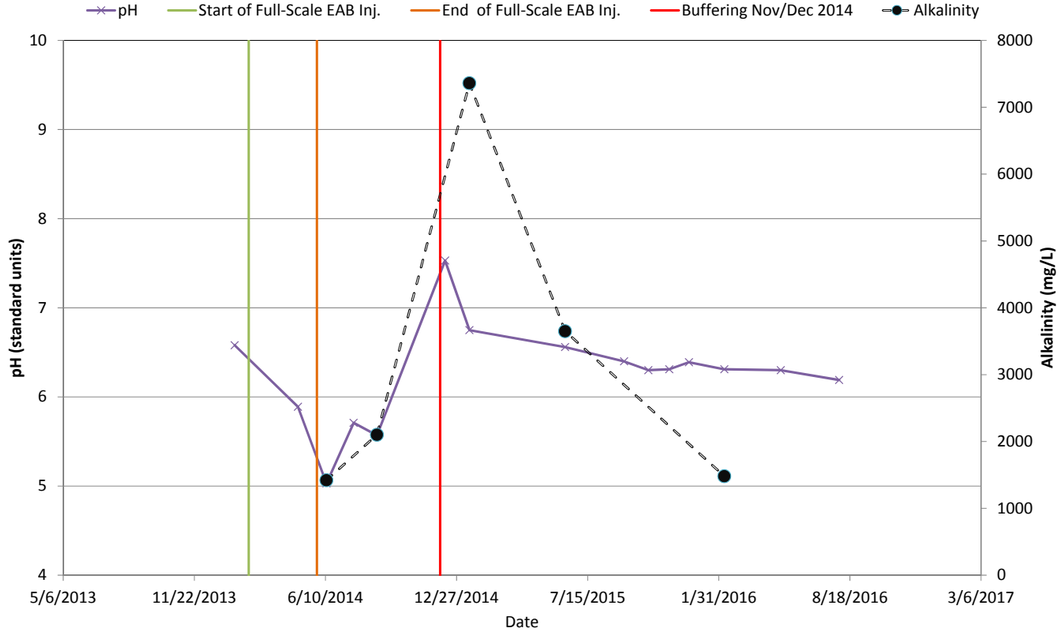
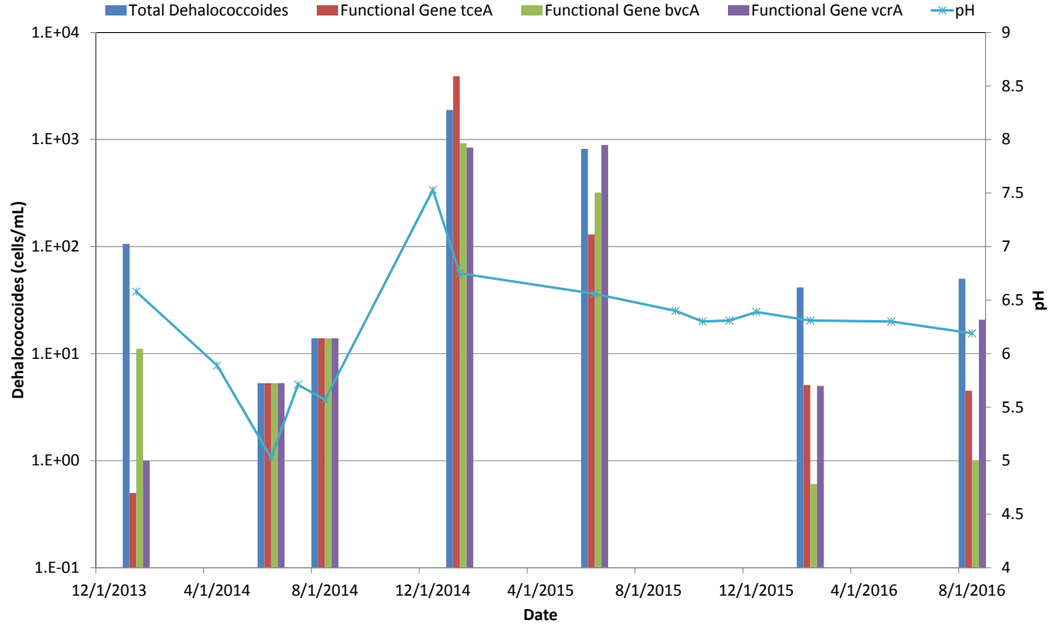
TCE
1,1,2,2-PCA
1,1,2-TCA
cis-1,2-DCE
trans-1,2-DCE
1,2-DCA
1,1-DCE
Vinyl Chloride
Chloroethane
Ethene
VOC Mass Concentration (ug/L)
25000
20000
15000
10000
5000
0
10/18/12
5/6/13
11/22/13
6/10/14
12/27/14
7/15/15
1/31/16
8/18/16
3/6/17
Date


EAB-5 VOC Molar Concentrations
PCE
TCE
1,1,2,2-PCA
cis-1,2-DCE
trans-1,2-DCE
1,1-DCE
1,1,2-TCA
1,2-DCA
Vinyl Chloride
Chloroethane
Ethene
Chloride
VOC Molar Concentration (umol/L)
1000
900
800
700
600
500
400
300
200
100
0
Chloride Molar Concentrations (umol/L)
4000
3500
3000
2500
2000
1500
1000
500
0
3/1/2013
7/1/2013
11/1/2013
3/1/2014
7/1/2014
11/1/2014
3/1/2015
7/1/2015
11/1/2015
3/1/2016
7/1/2016
Date





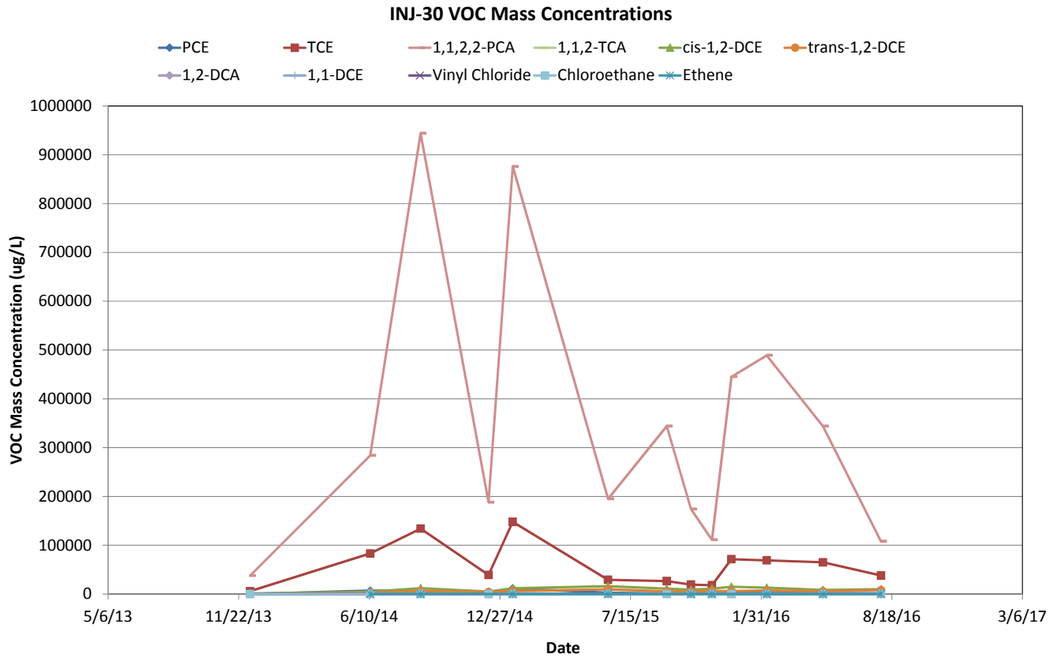


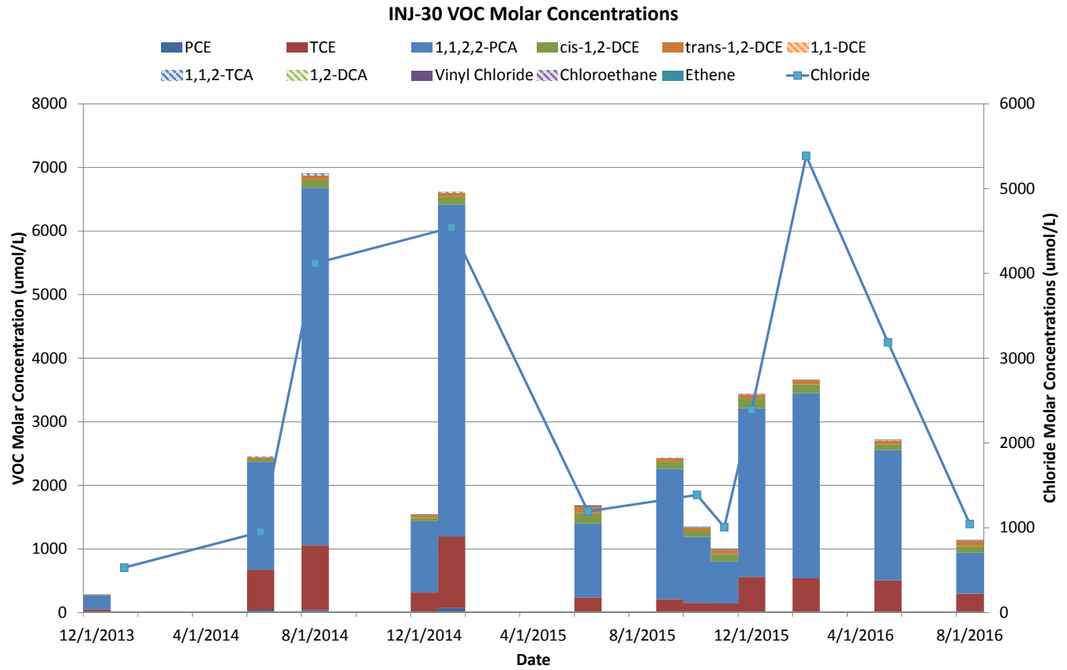


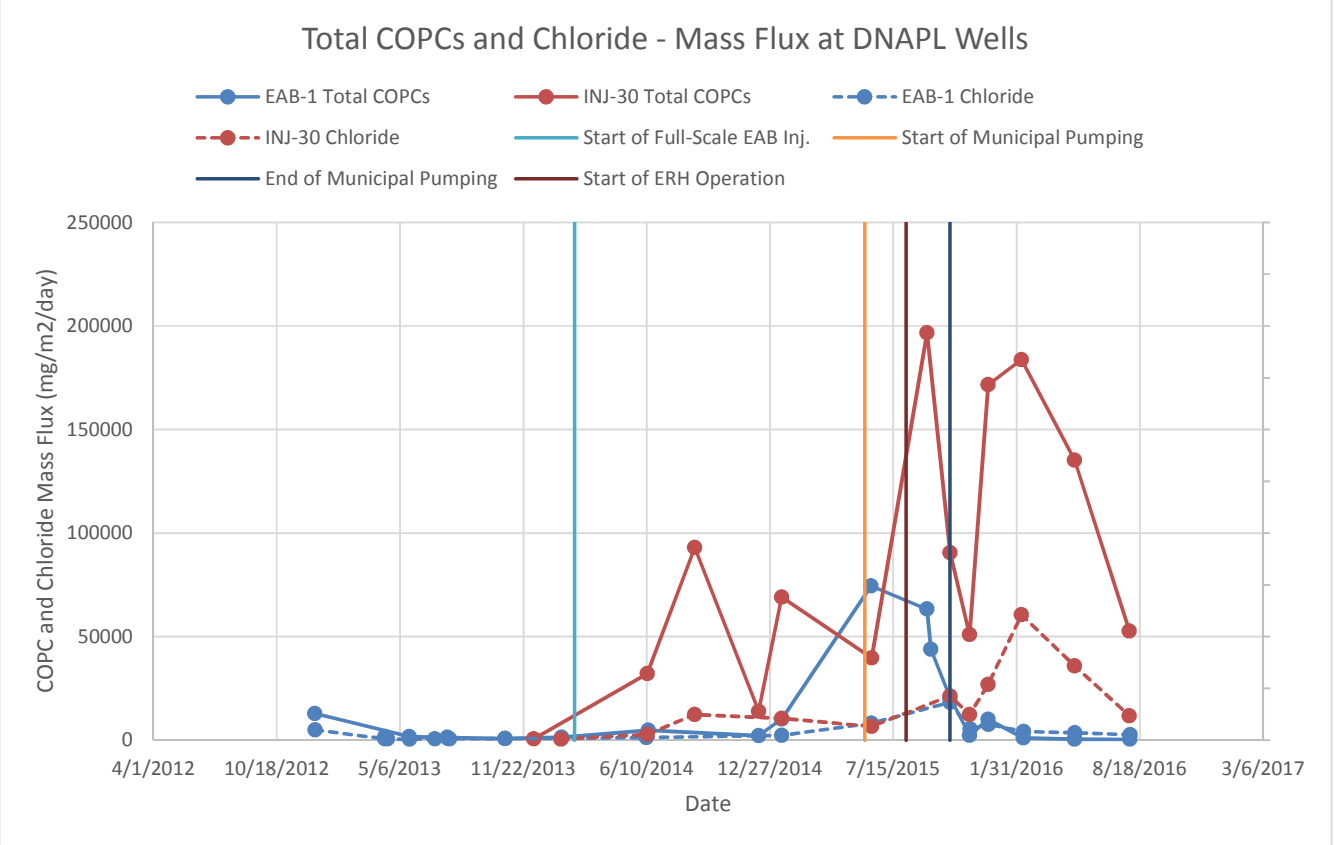
CDM Smith

Analytical Data Trends for Thermally Enhanced Bioremediation Wells

Groundwater Performance Monitoring
Well 12A Superfund Site, Tacoma, Washington


INJ-30 VOC Mass Concentrations
PCE
TCE
1,1,2,2-PCA
1,1,2-TCA
cis-1,2-DCE
trans-1,2-DCE
1,2-DCA
1,1-DCE
Vinyl Chloride
Chloroethane
Ethene
VOC Mass Concentration (ug/L)
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
5/6/13
11/22/13
6/10/14
12/27/14
7/15/15
1/31/16
8/18/16
3/6/17
Date


INJ-30 VOC Molar Concentrations
PCE
TCE
1,1,2,2-PCA
cis-1,2-DCE
trans-1,2-DCE
1,1-DCE
1,1,2-TCA
1,2-DCA
Vinyl Chloride
Chloroethane
Ethene
Chloride
VOC Molar Concentration (umol/L)
Chloride Molar Concentrations (umol/L)
8000
7000
6000
5000
4000
3000
2000
1000
0
6000
5000
4000
3000
2000
1000
0
12/1/2013
4/1/2014
8/1/2014
12/1/2014
4/1/2015
8/1/2015
12/1/2015
4/1/2016
8/1/2016
Date



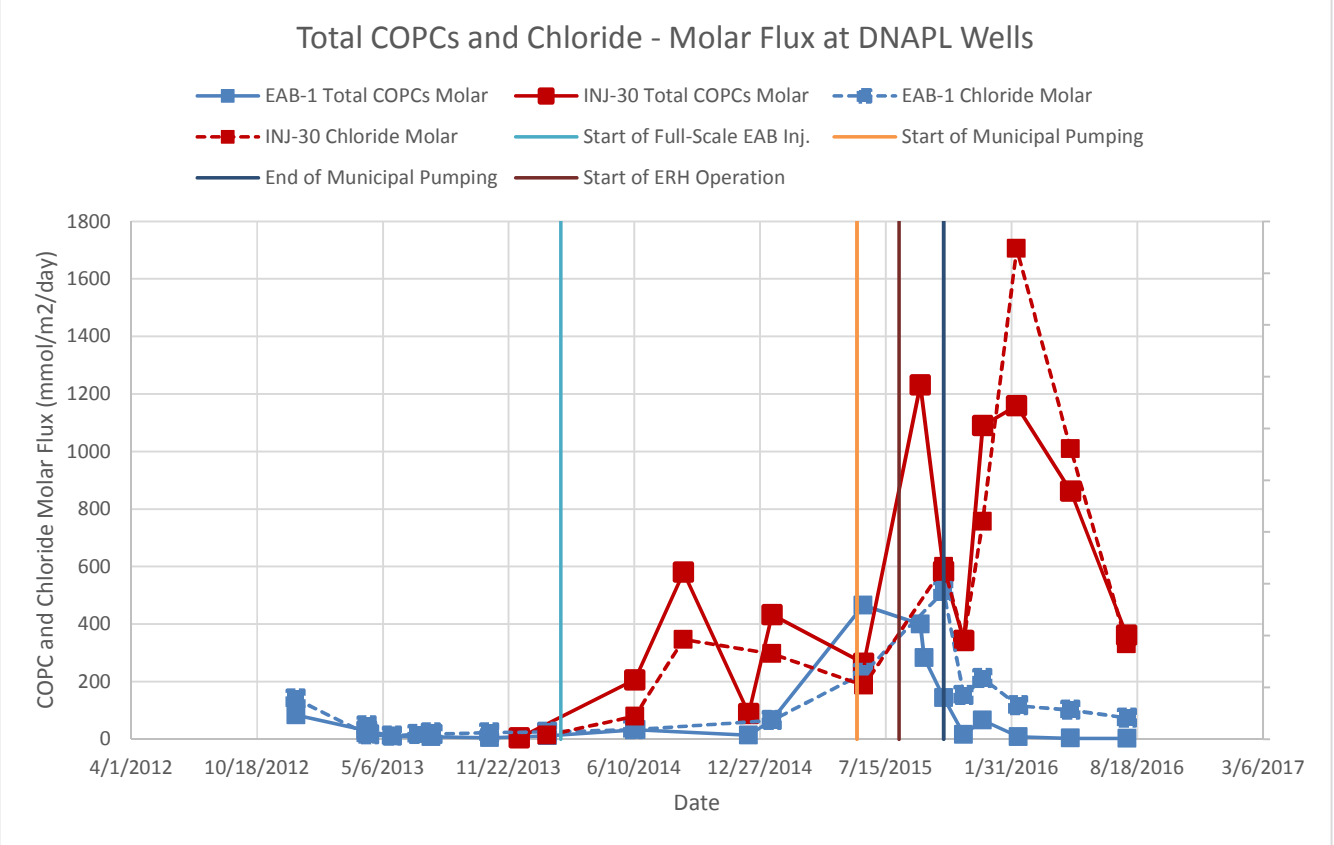
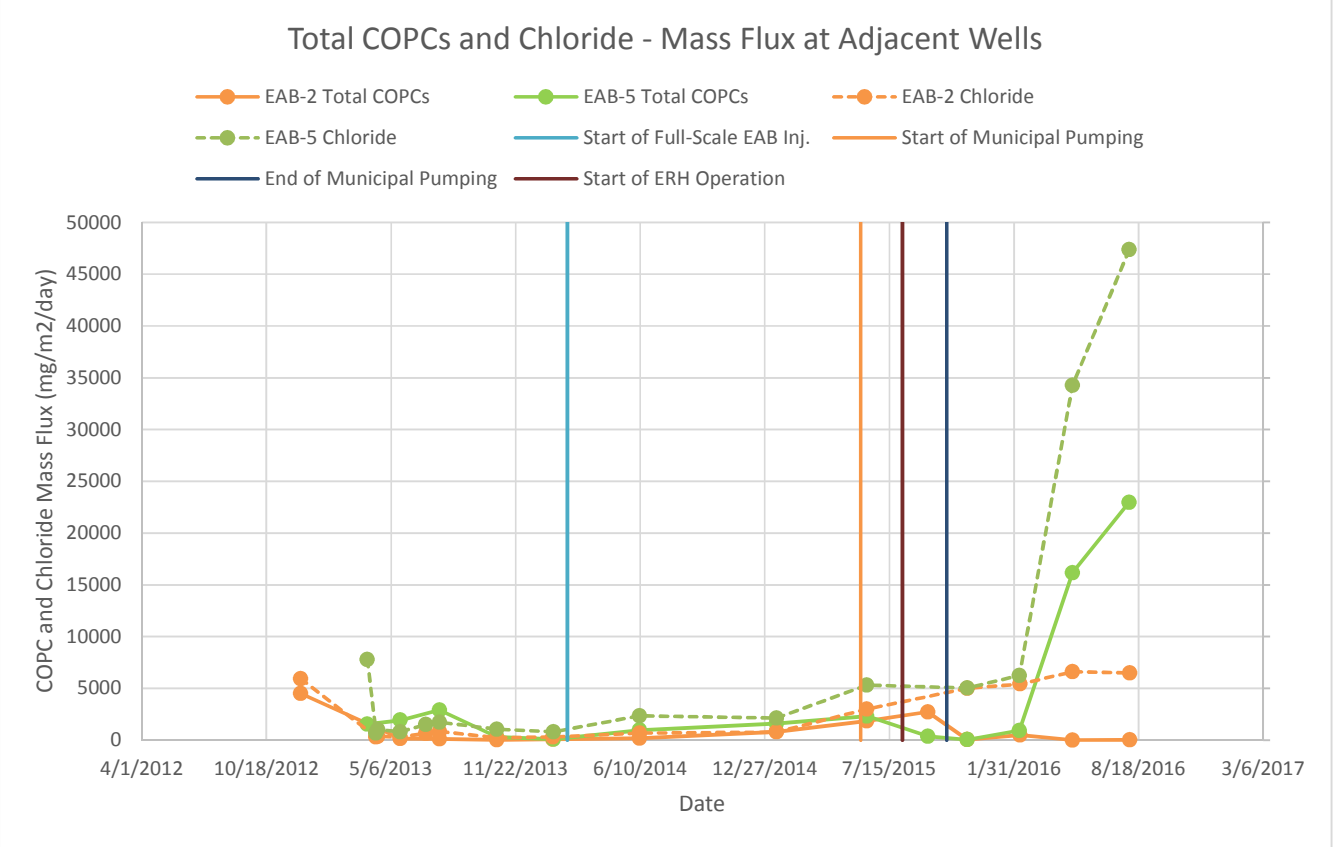


Figure C-1. Total COPC and Chloride Flux - DNAPL Wells



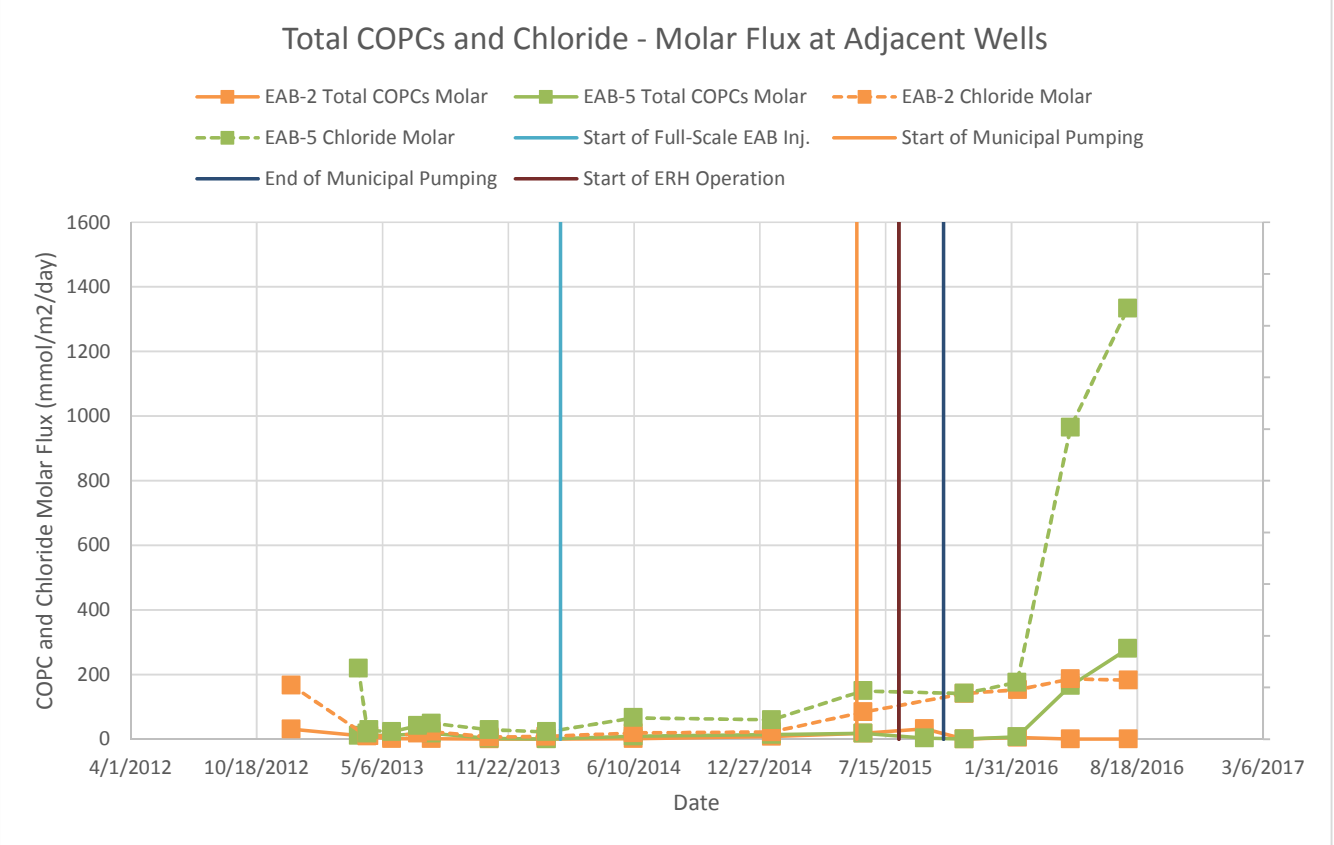
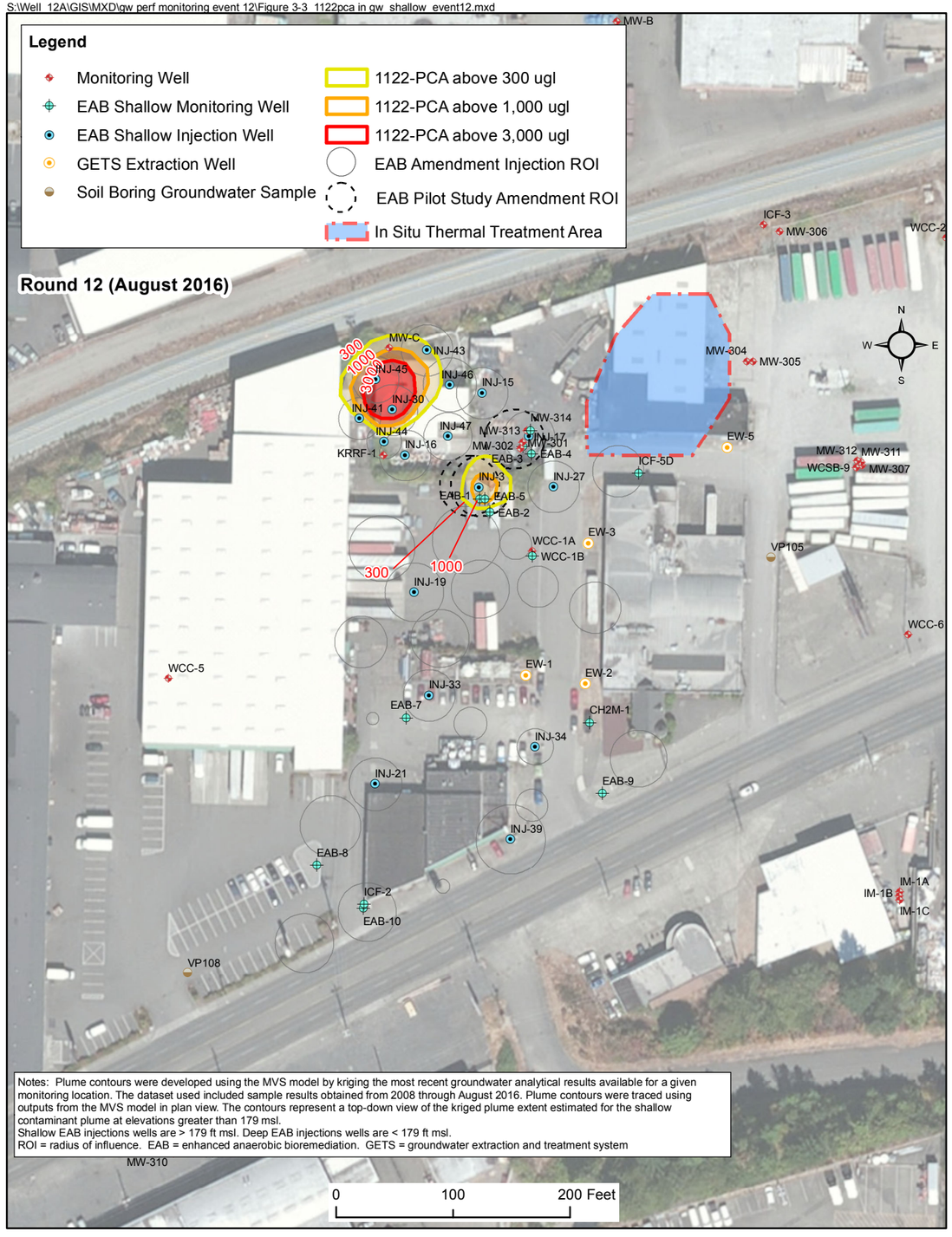


Figure C-2. Total COPC and Chloride Flux - Nearby Wells

S:\Well_12A\GIS\MXD\gw perf monitoring event 12\Figure 3-3_1122pca in gw_shallow_event12.mxd



Notes: Plume contours were developed using the MVS model by kriging the most recent groundwater analytical results available for a given monitoring location. The dataset used included sample results obtained from 2008 through August 2016. Plume contours were traced using outputs from the MVS model in plan view. The contours represent a top-down view of the kriged plume extent estimated for the shallow contaminant plume at elevations greater than 179 msl.
Shallow EAB injections wells are > 179 ft msl. Deep EAB injections wells are < 179 ft msl.
ROI = radius of influence. EAB = enhanced anaerobic bioremediation. GETS = groundwater extraction and treatment system

CDM Smith

Well 12A Superfund Site
Tacoma, Washington

Figure C-3
1,1,2,2-PCA
in Shallow Groundwater (>179 ft msl)
Round 12 (August 2016)

S:\Well_12A\GIS\MXD\gw perf monitoring event 12\Figure 3-7_pce in gw_shallow_event12.mxd

Round 6 (January 2014)

Round 12 (August 2016)

Legend

- Monitoring Well
- EAB Shallow Monitoring Well
- EAB Shallow Injection Well
- GETS Extraction Well
- Soil Boring Groundwater Sample
- PCE above 300 ugl
- PCE above 1000 ugl
- EAB Amendment Injection ROI
- EAB Pilot Study Amendment ROI
- In Situ Thermal Treatment Area

Notes: Plume contours were developed using the MVS model by kriging the most recent groundwater analytical results available for a given monitoring location. The dataset used included sample results obtained from 2008 through August 2016. Plume contours were traced using outputs from the MVS model in plan view. The contours represent a top-down view of the kriged plume extent estimated for the shallow contaminant plume at elevations greater than 179 msl.
Shallow EAB injections wells are > 179 ft msl. Deep EAB injections wells are < 179 ft msl.
ROI = radius of influence. EAB = enhanced anaerobic bioremediation. GETS = groundwater extraction and treatment system

0 100 200 Feet

CDM Smith

Well 12A Superfund Site
Tacoma, Washington

Figure C-4
PCE
in Shallow Groundwater (>179 ft msl)
Round 12 (August 2016)

S:\Well_12A\GIS\MXD\gw perf monitoring event 12\Figure 3-8 tce in gw_shallow_event12.mxd

Round 6 (January 2014)

Round 12 (August 2016)

Legend

- Monitoring Well
- EAB Shallow Monitoring Well
- EAB Shallow Injection Well
- GETS Extraction Well
- Soil Boring Groundwater Sample
- TCE above 300 ugl
- TCE above 1000 ugl
- TCE above 3000 ugl
- EAB Amendment Injection ROI
- EAB Pilot Study Amendment ROI
- In Situ Thermal Treatment Area

Notes: Plume contours were developed using the MVS model by kriging the most recent groundwater analytical results available for a given monitoring location. The dataset used included sample results obtained from 2008 through August 2016. Plume contours were traced using outputs from the MVS model in plan view. The contours represent a top-down view of the kriged plume extent estimated for the shallow contaminant plume at elevations greater than 179 msl.
Shallow EAB injections wells are > 179 ft msl. Deep EAB injections wells are < 179 ft msl.
ROI = radius of influence. EAB = enhanced anaerobic bioremediation. GETS = groundwater extraction and treatment system

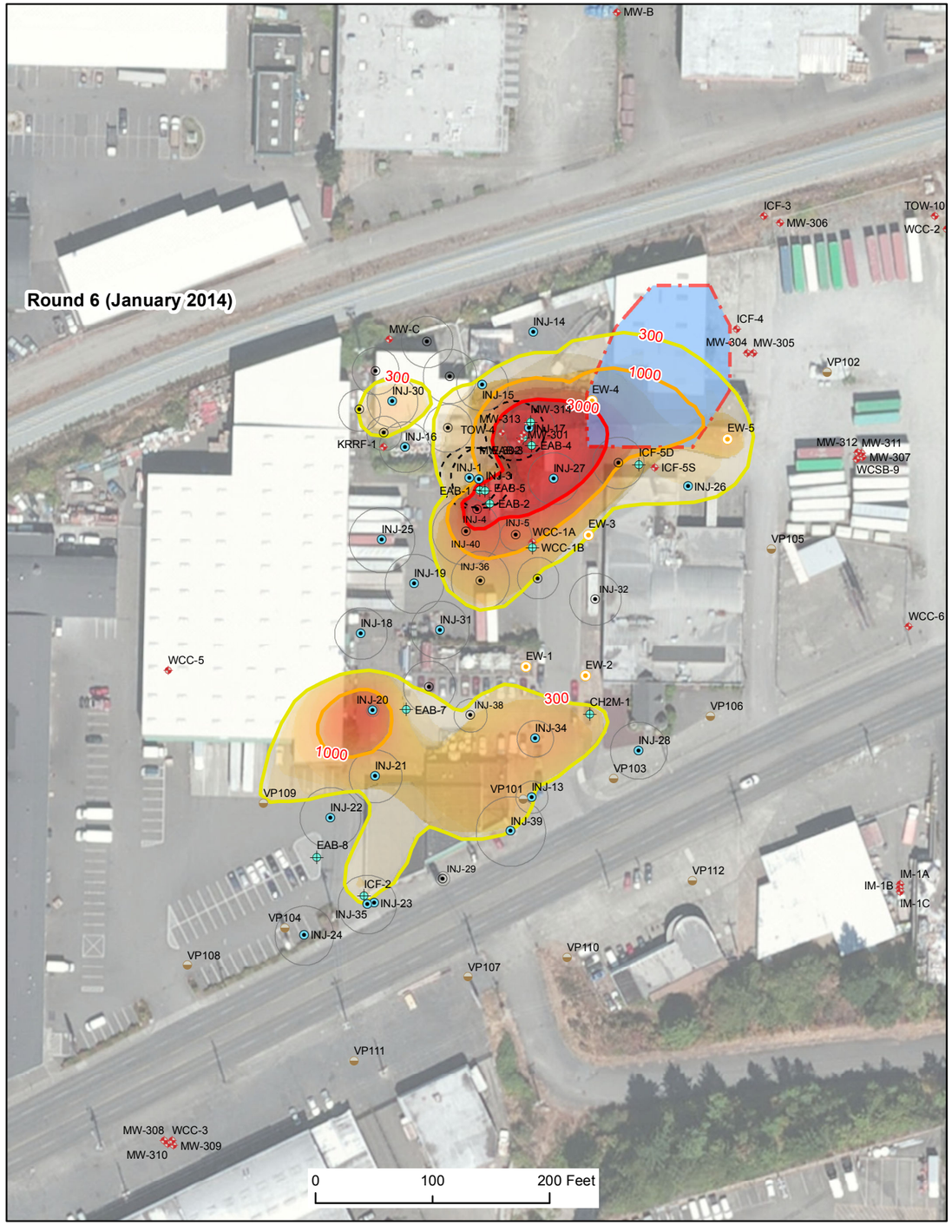
0 100 200 Feet

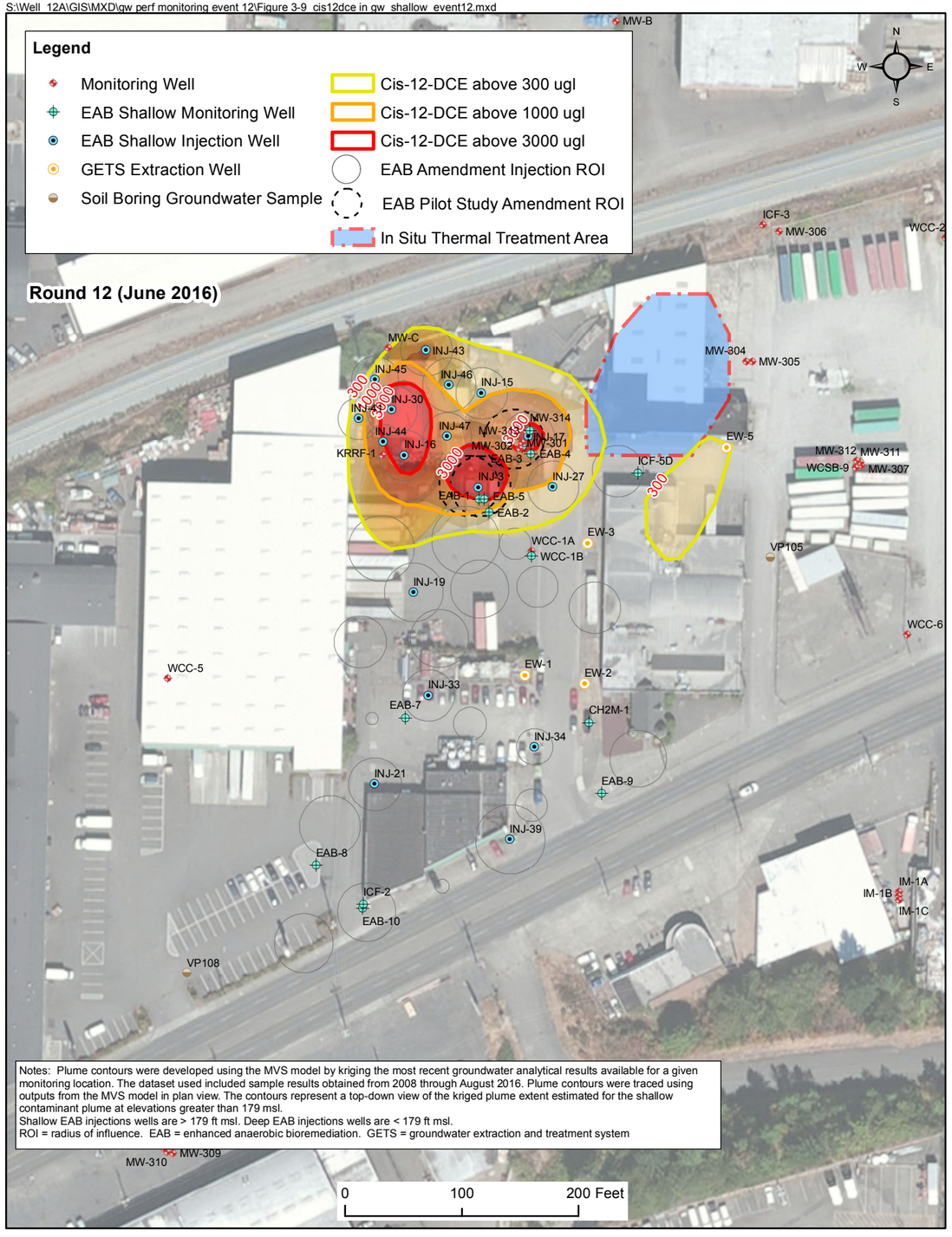
CDM Smith

Well 12A Superfund Site
Tacoma, Washington

Figure C-5
TCE
in Shallow Groundwater (>179 ft msl)
Round 12 (August 2016)

S:\Well_12A\GIS\MXD\gw perf monitoring event 12\Figure 3-9_cis12dce in gw_shallow_event12.mxd





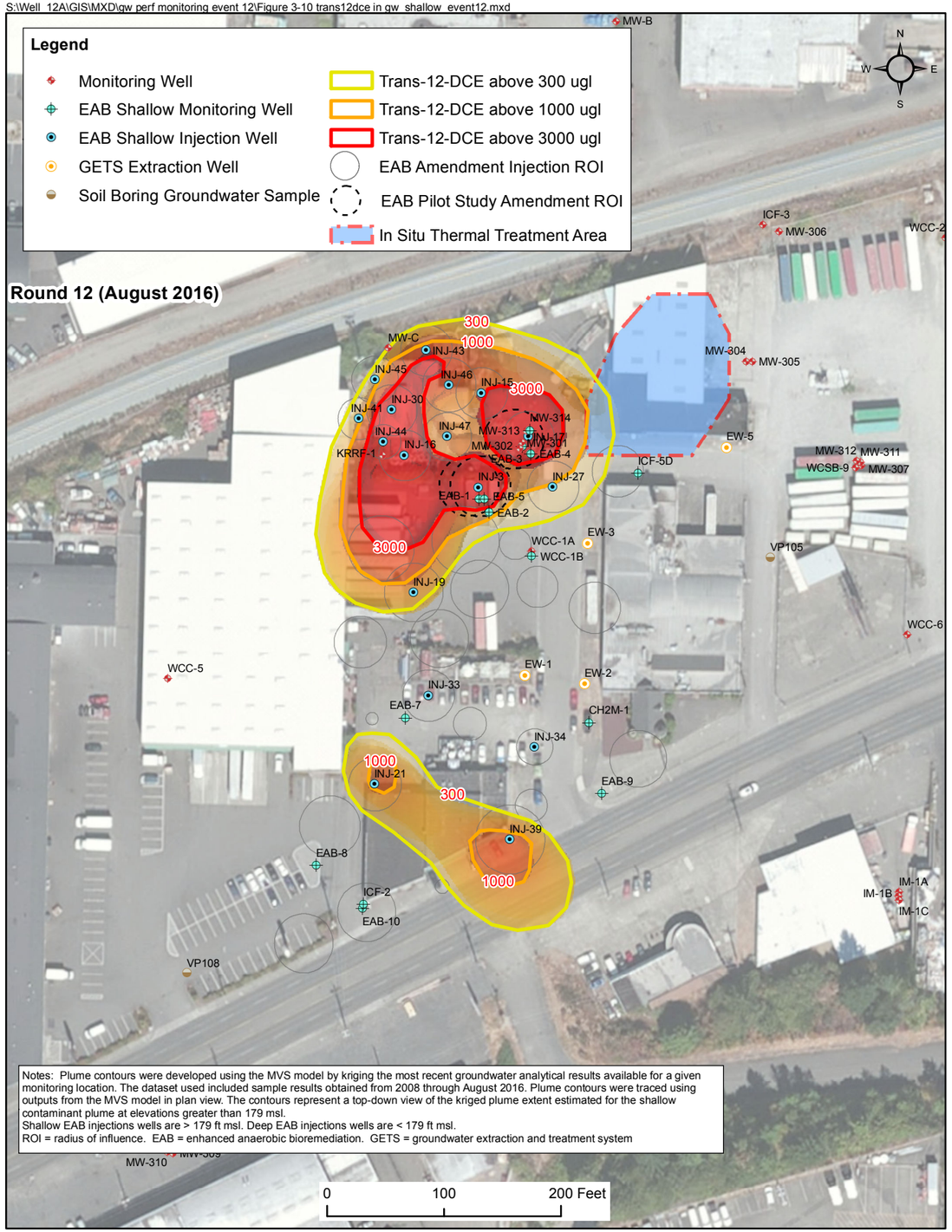
Notes: Plume contours were developed using the MVS model by kriging the most recent groundwater analytical results available for a given monitoring location. The dataset used included sample results obtained from 2008 through August 2016. Plume contours were traced using outputs from the MVS model in plan view. The contours represent a top-down view of the kriged plume extent estimated for the shallow contaminant plume at elevations greater than 179 msl.
Shallow EAB injections wells are > 179 ft msl. Deep EAB injections wells are < 179 ft msl.
ROI = radius of influence. EAB = enhanced anaerobic bioremediation. GETS = groundwater extraction and treatment system

CDM Smith

Well 12A Superfund Site
Tacoma, Washington

Figure C-6
Cis-1,2-DCE
in Shallow Groundwater (>179 ft msl)
Round 12 (August 2016)

S:\Well_12A\GIS\MXD\gw perf monitoring event 12\Figure 3-10 trans12dce in gw_shallow_event12.mxd

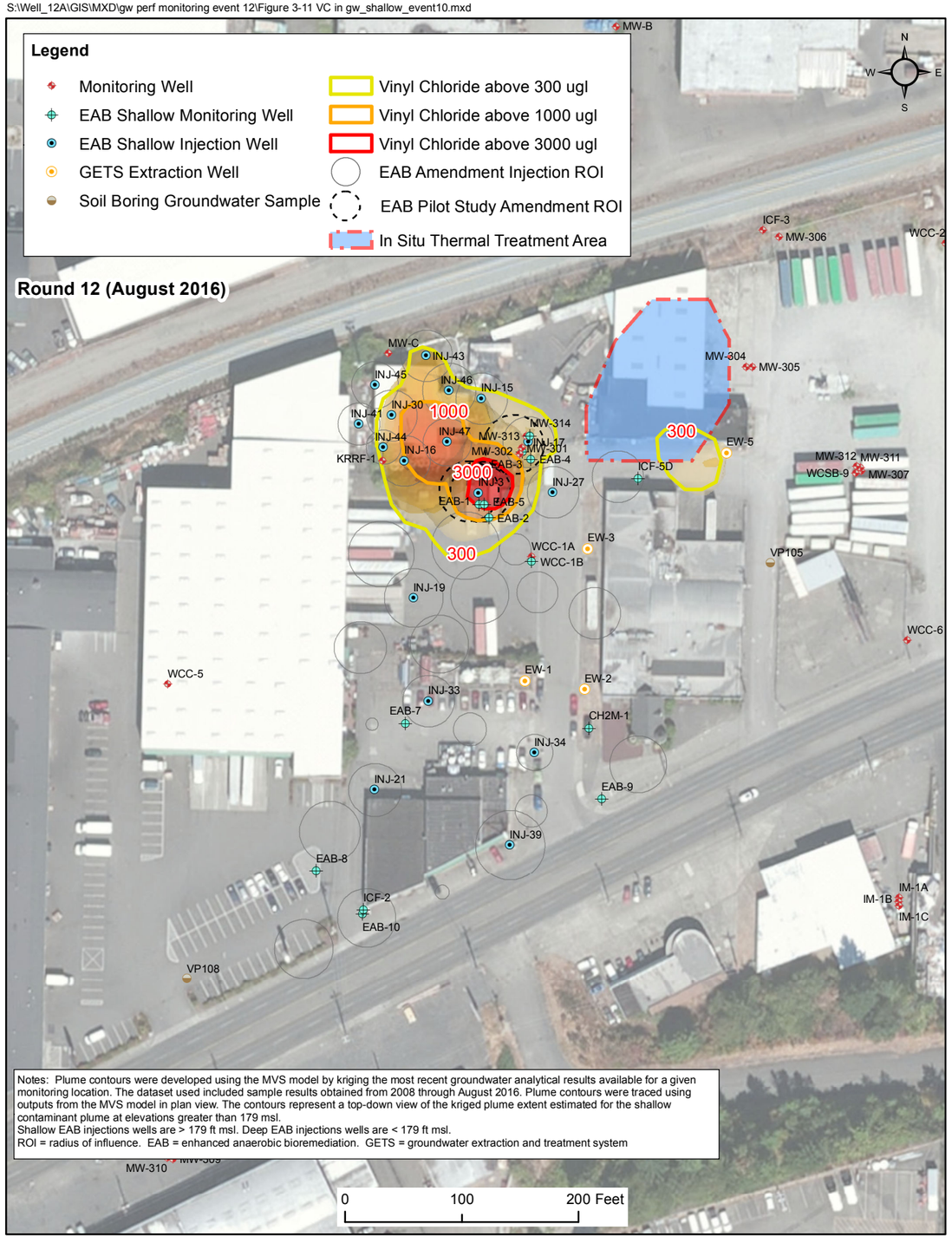


CDM Smith

Well 12A Superfund Site
Tacoma, Washington

Figure C-7
Trans-1,2-DCE
in Shallow Groundwater (>179 ft msl)
Round 12 (August)

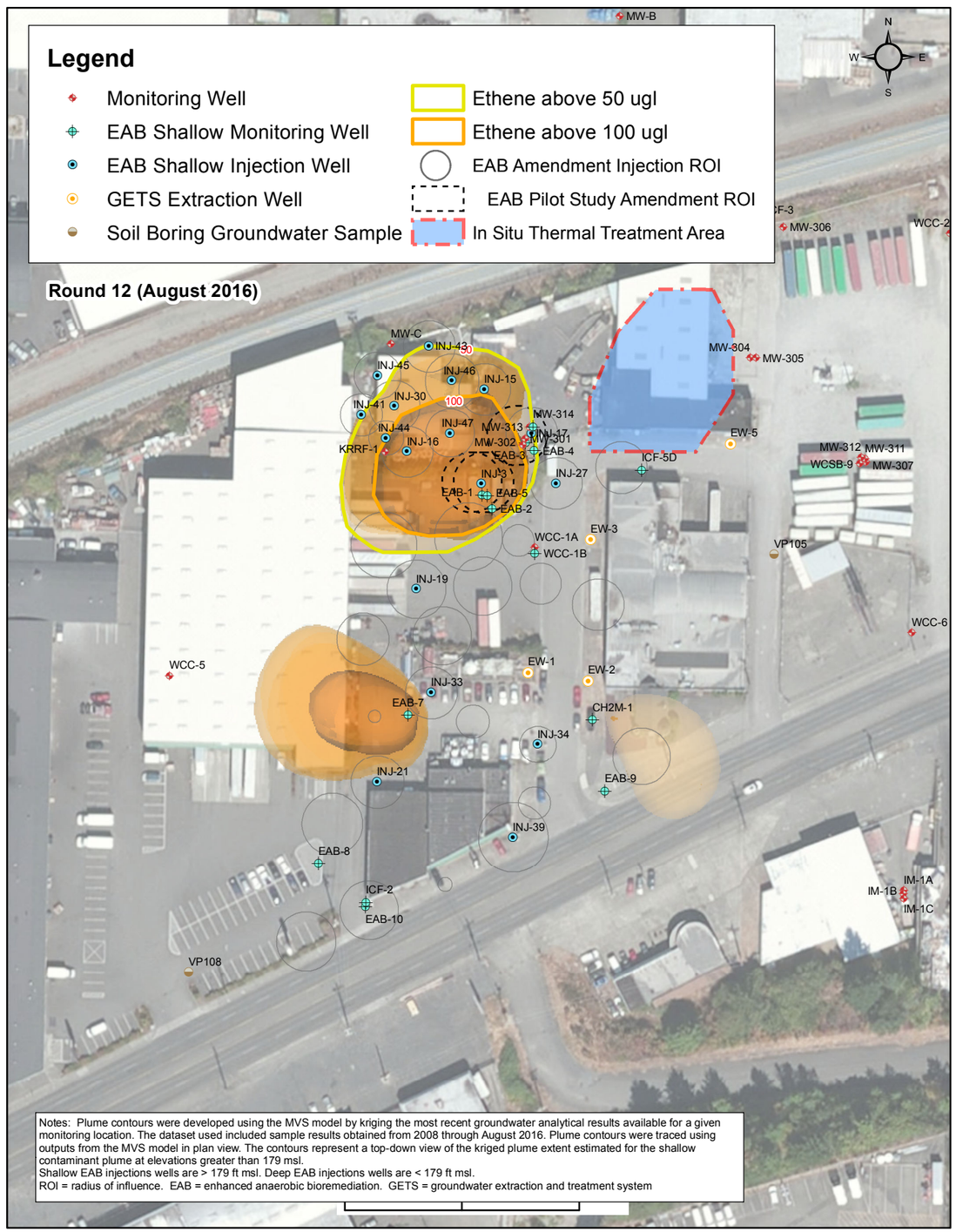
S:\Well_12A\GIS\MXD\gw perf monitoring event 12\Figure 3-11 VC in gw_shallow_event10.mxd



CDM Smith

Well 12A Superfund Site
Tacoma, Washington

Figure C-8
Vinyl Chloride
in Shallow Groundwater (>179 ft msl)
Round 12 (August 2016)



CDM Smith

0 50 100 200 300 Feet

Well 12A Superfund Site
Tacoma, Washington

Figure C-9
Ethene
in Shallow Groundwater (>179 ft msl)
Round 12 (August 2016)

APPENDIX D – SITE INSPECTION TRIP REPORT, PHOTOS, AND CHECKLIST

Trip Report
Well 12A, Commencement Bay, South Tacoma Channel Superfund Site, Tacoma, WA

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1. INTRODUCTION

a. Date of Visit: 04 April 2018

b. Location: Vicinity of 3011 S Fife St (near former Time Oil Building) and vicinity of 3542 S Pine St (Well 12A), Tacoma, WA 98409

c. Purpose: A site visit was conducted to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the Five-Year Review Report.

d. Participants:

Name	Company, Title	Phone Number
Karl J. Kunas, P.E.	USACE, Project and Program Manager	206-764-3448
Leanna Woods Pan	USACE, Environmental Engineer	206-764-3518
Alison M. Suess, Ph.D.	USACE, Chemist	206-764-3264

2. SUMMARY

A site visit to the Well 12A OU at the Commencement Bay, South Tacoma Channel Superfund Site was conducted on 04 April 2018. Karl Kunas gave an overview of the site's remedial history. The participants observed the paved areas near the location of the former Time Oil Building where the soil vapor extraction (SVE), bioremediation, excavation, and thermal remediation actions took place. The participants also observed the Groundwater Extraction and Treatment System (GETS) area and the Well 12A area. Some signage at the area near the location of the former Time Oil Building and at the GETS area has out of date phone numbers and/or peeling labels.

3. DISCUSSION

On 04 April 2018, Karl Kunas, Leanna Pan, and Alison Suess drove to the vicinity of 3011 S Fife St, near the location of the former Time Oil Building. The site visit started at 0948 hours, and the weather was 43 degrees and cloudy with occasional light rain that turned into steady light rain over the course of the visit.

The visit started at the current recycling business area. Mr. Kunas, the USACE Project Manager, led the tour. The participants observed the paved area over the former bioremediation area, then walked west, observing the paved areas over the former excavation area and thermal remediation area. The participants observed the former Soil Vapor Extraction (SVE) equipment building. Barrels holding drill cutting waste from installation of the compliance monitoring wells are currently being stored outside the former SVE building. The property encompassing the

recycling business and the former SVE building is fenced, with gates open during the day. Signage on the fence is in good condition except that labels with contact phone number information are peeling.

The participants walked south down S Fife St, passing the current trucking business area, observing compliance monitoring wells in the paved area.

The participants arrived at the Groundwater Evaluation and Treatment System (GETS). The GETS area is fenced and locked. Emergency phone number on the signs was changed to 911, but the labels are peeling off the signs.

The participants then drove to the Well 12A and observed the area. The area is fenced and locked.

The site visit ended at approximately 1045.

4. ACTIONS

The USACE will incorporate information obtained from the site visit into the Five Year Review report.

Alison M. Suess, Ph.D
Chemist
CENWS-ENT-E

Site Visit Photos

Recycling business, outside the fence. (NE)

Recycling business, inside fence, showing paved former bioremediation area. (NE)

Blue building is the former SVE equipment building. Former thermal remediation area is now paved. (NE)

Former excavation area is now paved. (N)

Former SVE building. Stored drums of drill cutting waste from installation of compliance monitoring wells. (NW)

Stored drums of drill cutting waste from installation of compliance monitoring wells (NW)

Stored drums of drill cutting waste from installation of compliance monitoring wells near former SVE building. (N)

Fence outside former SVE building and thermal remediation area. (NW)

Paved former thermal remediation area. (W)

Closeup of paving in former thermal remediation area. (W)

Trucking business area between former SVE building and GETS area. (N)

Trucking business area. (W)

A compliance monitoring well in the trucking business area, with the recycling business in view. (N)

Groundwater Evaluation and Treatment System (GETS). (W)

GETS signage. (W)


GETS fencing. (W)

GETS area. (W)

GETS area. (NW)

GETS, fencing, and signage. (W)

GETS area. (W)

Area surrounding GETS. (S)

Area surrounding GETS. (E)

Well 12A air strippers. (N)

Well 12A and fencing. (NE)

Well 12A blow-out pond used to purge well. (N)

Well 12A control building and electrical. (W)

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Well 12A/Time Oil	**Date of inspection: 04 April 2018**
Location: Tacoma, WA	**EPA ID: WAD980726301**
Agency, office, or company leading the five-year review: EPA Region 10	**Weather/temperature: Light rain, 43 ºF**

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: *Well-head treatment (Well 12A), Groundwater monitoring*
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached
   _____
   _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached
   _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency: Washington State Department of Ecology
Contact: Chris Maurer Project Manager 27 April 2018 _____
Name Title Date Phone no.
Problems; suggestions; ☒ Report attached See Appendix E
_____

Agency: _____
Contact: _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency: _____
Contact: _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency: _____
Contact: _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☒ Report attached.

Local Property Owner (see Appendix E)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks_____
_____

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☐ Up to date ☐ N/A
☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A
Remarks_____
_____

3.	**O&M and OSHA Training Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks_____			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_____			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_____			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_____			
7.	**Groundwater Monitoring Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks_____			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_____			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☒ Readily available	☐ Up to date	☐ N/A
	Remarks_____			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_____			

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☒ Other City of Tacoma Water manages the Well 12A wellhead treatment system

2. **O&M Cost Records**

☒ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate $100,000 per year (from previous FYR Chris Maurer Interview)
☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: None described.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks The former Time Oil property, GETS, and Well 12A wellhead treatment system are all enclosed in fencing in good condition. Gates at the former Time Oil Property are left open during the day for business access.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Sites are clearly labeled with site information, however, some contact phone number labels are peeling at former Time Oil property and GETS.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☒ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☒ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: All residents within this area use municipal water. The likelihood of a private owner installing a drinking water well is small. Vapor intrusion risk into buildings from contaminated soil and groundwater contamination exists, although since no one currently lives on the property, exposure likelihood is low. EPA plans to evaluate VI risk after active remediation is complete and institute ICs at that time if needed.

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks:

2. **Land use changes on site** ☐ N/A

Remarks: Land use remains commercial/industrial.

3. **Land use changes off site** ☐ N/A

Remarks: No changes observed.

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks:

B. Other Site Conditions

Remarks:

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition ☐ All required wells properly operating G Needs Maintenance G N/A
Remarks___Well 12A and GETS not operating during site visit_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent)_____
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks_____
_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks_____
_____

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
Remarks_____
_____

4. **Discharge Structure and Appurtenances**
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks_____
_____

5. **Treatment Building(s)**
☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks_____
_____

6. **Monitoring Wells** (pump and treatment remedy)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

D. Monitoring Data

Monitoring Data
☒ Is routinely submitted on time ☐ Is of acceptable quality

Monitoring data suggests:
☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks_____
_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). ___See FYR_____
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. ___See FYR_____
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. ___See FYR_____
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. ___See FYR_____

APPENDIX E – PUBLIC NOTICE

EPA United States Environmental Protection Agency

Commencement Bay – South Tacoma Channel Superfund Site
Site Review Underway – Input Welcomed

EPA Welcomes Your Feedback

EPA reviews Superfund sites every five years to assess cleanup progress and identify any additional actions that might be needed. The 2018 review is now underway and scheduled to be completed by September. As part of the review, EPA would like to hear from the community. If you have observations, information or concerns pertinent to EPA's site review, or would like to be interviewed as a part of the review, please contact Jeremy Jennings or Christopher Cora, EPA Remedial Project Managers, by **June 11, 2018**.

Evaluation of Cleanup Measures

The 2.5 square-mile Commencement Bay – South Tacoma Channel Site includes three separate areas; the South Tacoma Field, the Tacoma Landfill, and Well 12A. The initial cleanup actions are complete for all three site areas.

South Tacoma Field

From 1892 to 1974 this area was used by Burlington Northern Railroad for rail car manufacturing, repair and maintenance. Iron and brass foundries also operated on-site and produced various rail car parts.

All hazardous wastes have been isolated and capped. Regular inspections and monitoring is ongoing.

Tacoma Landfill

Beginning in 1960, the landfill accepted municipal, industrial, construction, demolition, and bulk wastes, including hazardous wastes. Groundwater was contaminated with volatile organic compounds and heavy metals. The landfill was closed in 2013. *Landfill gases are not moving beyond the landfill boundary. Monitoring reports from most groundwater wells show compliance with cleanup levels.*

Well 12A

Well 12A is one of 13 wells used by the city of Tacoma to meet peak summer and emergency water demands. The well was taken out of operation when it was found to be contaminated. Groundwater treatment began in 1983. *A 2009 amendment to the cleanup plan recommended additional remedial actions. These included excavating contaminated soils, heating soil and groundwater to remove solvents and petroleum, and using biological treatment to remove solvents in groundwater. EPA's evaluation of these recent actions will be completed in 2018.*

Contacts and information:

For South Tacoma Field and Tacoma Landfill:
Jeremy Jennings at jennings.jeremy@epa.gov or 206-553-2724 / 800-424-4372 x 2724
For Well 12A: Christopher Cora at cora.christopher@epa.gov or 206-553-1478 / 800-424-4372 x 1478
For more site information visit: https://www.epa.gov/superfund/commencement-bay-stc

TDD and/or TTY users may call the Federal Relay Service at 800-877-8339. Please give the operator phone number 208-756-2311, then ask for Christopher Cora or Jeremy Jennings.

Commencement Bay – South Tacoma Channel Superfund Site
Site Review Underway – Input Welcomed

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APPENDIX F – INTERVIEWS

South Tacoma Channel – Well 12A Superfund Site — Five-Year Review Interview Form

Site Name: South Tacoma Channel – Well 12A **EPA ID No.:** WAD980726301

Interviewer Name: Alison Suess **Affiliation:** USACE
Subject Name: Chris Maurer **Affiliation:** Department of Ecology
Subject Contact Information: Chris Maurer, PO Box 47600, Olympia, Washington 98504-7600, cmau461@ECY.WA.GOV
Time: Not applicable **Date:** 27 April 2018
Interview Location: Not applicable

Interview Format: **Other: EMAIL**

Interview Category: **State Agency**

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The project is making slow but steady progress toward successful remediation.

2. What is your assessment of the current performance of the remedy in place at the Site?

   The current multi-phase remedy appears to have worked. The extension of the site remediation into the future is under discussion between EPA and the State. Determination of what actions will sufficiently protect the City of Tacoma's Well 12-A remain to be done.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   No

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.

   The State has worked closely with, and advised EPA, on the different remedial measures that EPA has undertaken. This cooperation has speeded up the remediation of this site.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?

No

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   Institutional controls remain to be determined. An Institutional Controls plan was developed but it is outdated and needs revision.

7. Are you aware of any changes in projected land use(s) at the Site?

   No

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   No

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

   Yes

South Tacoma Channel – Well 12A Superfund Site **Five-Year Review Interview Form**

Site Name: South Tacoma Channel – Well 12A **EPA ID No.:** WAD980726301

Interviewer Name: Alison Suess **Affiliation:** U.S. Army Corps of Engineers
Subject Name: Local Property Owner **Affiliation:** Property Owner
Subject Contact Information: Local Property Owner
Time: Not Applicable **Date:** 04 May 2018
Interview Location: Not Applicable

Interview Format: **Other: EMAIL**

Interview Category: **Residents**

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   Having owned the adjacent property for 22 years, and having DOE water filtration site on my property, yes, I am familiar with this site.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The current cleanup seems to be going well. Maintenance, meaning the landscaping etc. on the site has never been very good.

3. What have been the effects of this Site on the surrounding community, if any?

   The surrounding community probably isn't even aware of what is going on. When they where drilling, it had an effect. I know these properties are encumbered by having a superfund site in the neighborhood.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   The site in the back was sold a few years back. That landlord opened a scrap metal facility. This has brought in all of the people junking scrap metal, and attracted a lot of homeless/vagrants. They push a stolen shopping cart here with scrap metal. Then leave the shopping carts.

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?

I have only heard from or spoken with anyone from the EPA when they need an access agreement signed. I would like to meet with someone and have a contact name.

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used?

   No.

7. Do you have any comments, suggestions or recommendations regarding any aspects of the project?

   As stated earlier, in the time we have owned the adjacent site, I think I have worked with three different environmental contractors. The current contractor, CDM Smith, have been by far the best to deal with. I think they have also had the best success in cleaning the site. Dominic Giaudrone, P.E. has been excellent to deal with, as have his employees.

   It would be nice to hear from the EPA with an update of how the process is going, if it is having any effect on the groundwater, what is expected to happen over the next few years, and issues that at least the adjacent property owners would have an interest in.

   I would like to know how long I must have the water filtration system on my property. We have a lease with the Washington State Department of Ecology but would like to redevelop the property at a later date. Even if we do not renew the lease with the State would that be possible?

Note: EPA followed up with the Local Property Owner to answer the questions.